Wireless Global Congress Americas

WGC AMERICAS

JUN 10 – JUNE 13 2024

Wi-Fi Innovation: Connecting Our Digital World

DALLAS MARRIOTT DOWNTOWN. DALLAS, TX, USA.

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Wireless Global Congress Americas

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Wireless Global Congress Americas

WGC Americas Speakers

Tiago Rodrigues
Wireless Broadband Alliance

Mike Finley
Boingo Wireless

Dr. Sarper Gokturk
Airties

Eric McLaughlin
Intel Corporation

Matt MacPherson
Cisco

JR Wilson
AT&T

Dr. Derek Peterson
Boingo Wireless

Wireless Global Congress Americas

Time	Presentation
9:00 AM (CT)	**Welcome address** Tiago Rodrigues, President & CEO, Wireless Broadband Alliance.
9:10 AM (CT)	**CONVERGENCE IN ACTION - Connecting North America's Largest Infrastructure Projects** Mike Finley, CEO, Boingo Wireless.
9:30 AM (CT	**Managed Home Wi-Fi: Keys to Successful Integration** Dr. Sarper Gokturk, Vice President of Innovation, Airties.
9:50 AM (CT)	**Wi-Fi 7 and AI PC Connectivity Innovation** Eric McLaughlin, VP Client Computing Group & GM Wireless Solutions Group, Client Computing Group, Intel Corporation.
10:10 AM (CT)	**Future Wireless – New Technologies for the Next Generation of Applications** Matt MacPherson, Wireless CTO, Cisco.
10:30 AM (CT)	**Operator Panel** JR Wilson, Chairman, Wireless Broadband Alliance; Vice President, Tower Strategy and Roaming, AT&T Services; Dr. Derek Peterson, Co-Chairman, Wireless Broadband Alliance; CTO, Boingo Wireless.
10:50 AM (CT)	COFFEE & NETWORKING

Wireless Global Congress Americas

Tiago Rodrigues

President & CEO, Wireless Broadband Alliance

Welcome address

Wireless Global Congress Americas, Dallas. June 10-13

Tiago Rodrigues
WBA President and CEO

WELCOME TO NEW MEMBERS

Wireless Broadband Alliance

Actiontec

alethea
Perfecting Broadband

ALTA LABS

AsiaRF

BIF
BROADBAND INDIA FORUM
"Think Tank for Digital Transformation"

cspire

CLAIR

embeD

EnGenius

Ford

Fuzion

GL·iNet

HEROS
TECHNOLOGY

ICOMERA
AN EQUANS COMPANY

KODENYX
SOFTWARE SOLUTIONS ENGINEERED TO LAST

NETGEAR

OOKLA

QUANTUM NETWORKS

SENAO

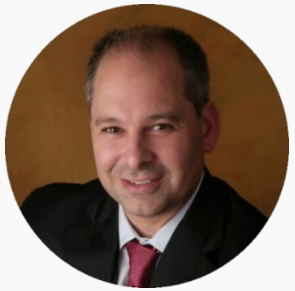
WIRELESS GUARDIAN

XNET

zetifi

THANK YOU

Big **Thank You** to AT&T Team for Hosting the Members Working Sessions, Board Meeting at setting up OpenRoaming at AT&T Headquarters



JR Wilson

Melody Eclavea

Erinn Hall

Jim Sturges

Kevin Franzen

And:

Craig Lanning
Chris Talley
Eric Baldomero
Julie Overman

Ryan Everhart
Tim Tweedle
Terri Scheele
Tony Ward

.. Many more..

ENJOY OPENROAMING IN DALLAS

Wireless Broadband Alliance

Enjoy OpenRoaming at
Marriot Downtown Dallas

Thank you to Marriott Team and Single Digits

Go to:
www.wballiance.com/openroaming/profile-signup/
download a profile and benefit from automatic and secure Wi-Fi

Install Once for Seamless Access!

Scan the QR code to download your OpenRoaming™ profile

WBA VISION

"SEAMLESS AND INTEROPERABLE WI-FI SERVICES"

OpenRoaming-Passpoint for Guest Wi-Fi

Convergence & Coexistence of Wi-Fi and Cellular

Next Generation Wireless Networks

ESTABLISHED **IN 2003**

200+ MEMBERSHIP **COMMUNITY**

PROJECTS & **PROGRAMS**

3 ANNUAL **EVENTS**

PROMOTION & **GO-TO-MARKET**

THOUGHT LEADERSHIP **& MARKET RESEARCH**

ENTERPRISE CONNECTIVITY FORUM WIRELESS BROADBAND ALLIANCE

APAC FORUM WIRELESS BROADBAND ALLIANCE

OPENROAMING™ WIRELESS BROADBAND ALLIANCE

WORLD™ Wi-Fi Day

WBA INDUSTRY AWARDS

CONNECTED COMMUNITIES FORUM WIRELESS BROADBAND ALLIANCE

INNOVATION FORUM POWERED BY WBA CTO GROUP

2024 PROGRAMS & PROJECTS

Wireless Broadband Alliance

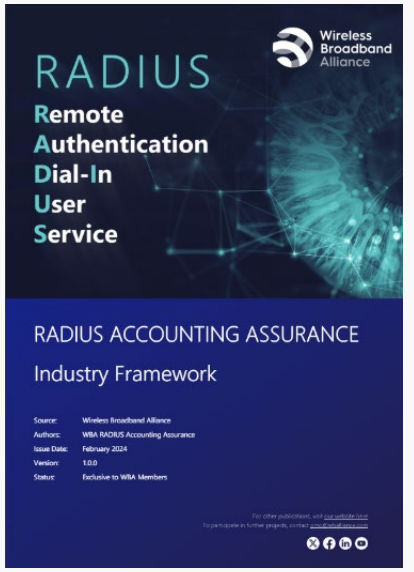
5G Work Group	**IoT** Work Group	**NextGen** Work Group	**Roaming** Work Group	**OpenRoaming** Work Group	**Testing & Interoperability** Work Group
Private & 5G Wi-Fi Convergence	IoT & Smart Home	Wi-Fi 7	RADIUS Accounting Assurance	Federated Onboarding Service for OpenRoaming	Access Network Metrics
Mission Critical & Emergency Services	Wi-Fi HaLow for IoT Applications	Wi-Fi Experience for Moving Networks	Wi-Fi Security Guidelines	OpenRoaming for Private LTE/5G	E2E Wi-Fi QoS & L4S
Enterprise Security for Private 5G Networks	Wi-Fi Sensing	Operator Managed Wi-Fi		OpenRoaming for IoT & FIDO Device Onboarding	Wi-Fi User & Device Identification
		AI/ML for Wi-Fi			WBA Tools & Testing Platforms

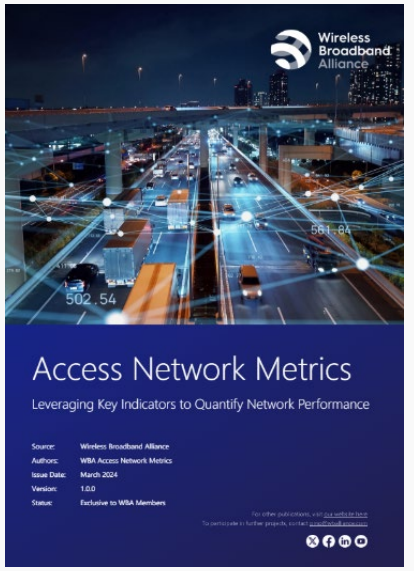
Policy & Regulatory Affairs Work Group

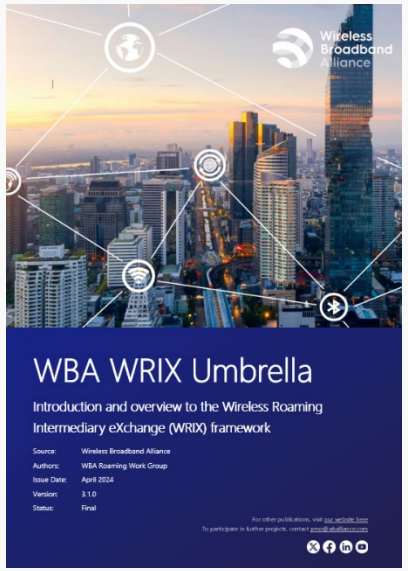
Market Work Group

2024 DELIVERABLES

1. Wi-Fi HaLow For IoT Applications
2. Signaling Location Information in RADIUS
3. RADIUS Accounting Assurance
4. End-to-End Wi-Fi QOS
5. Access Network QoS Metrics
6. WRIX Standards for Wi-Fi Roaming Update
7. OpenRoaming PKI Guidelines
8. Federated Onboarding Service for OpenRoaming
9. Venue Requirements for User Engagement
10. Wi-Fi Experience for Moving Networks
11. Private 5G & Wi-Fi Convergence
12. OpenRoaming and FIDO Device Onboarding (FDO)







OPENROAMING FOR IOT

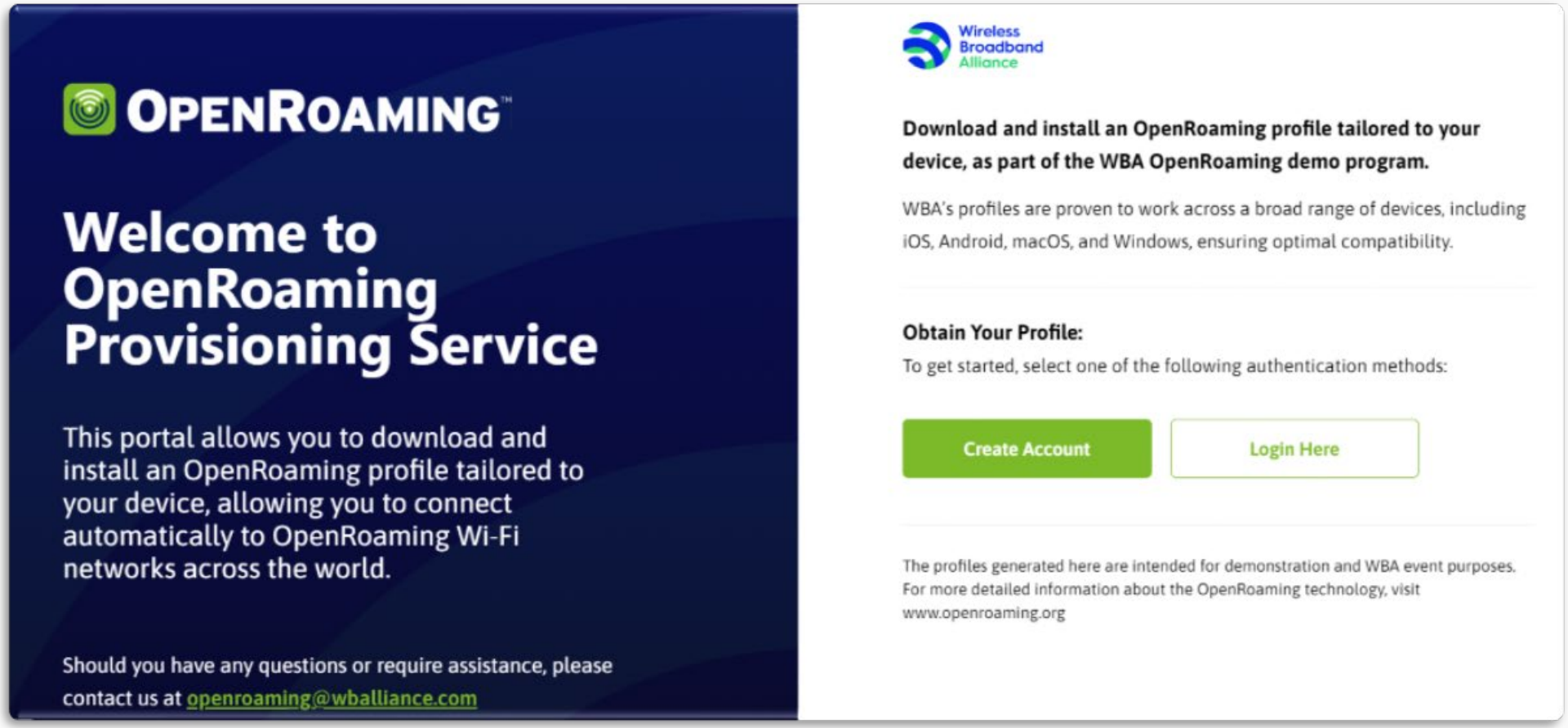
Evolve OpenRoaming-Passpoint for IoT

- IoT Credential Provisioning with OpenRoaming-Passpoint
- WBA-FIDO Alliance Collaboration
- OpenRoaming and FIDO Device Onboarding (FDO) specification

WBA Github update for Raspberry Pi for testing https://github.com/wireless-broadband-alliance/openroaming-config/blob/main/rpi-passpoint

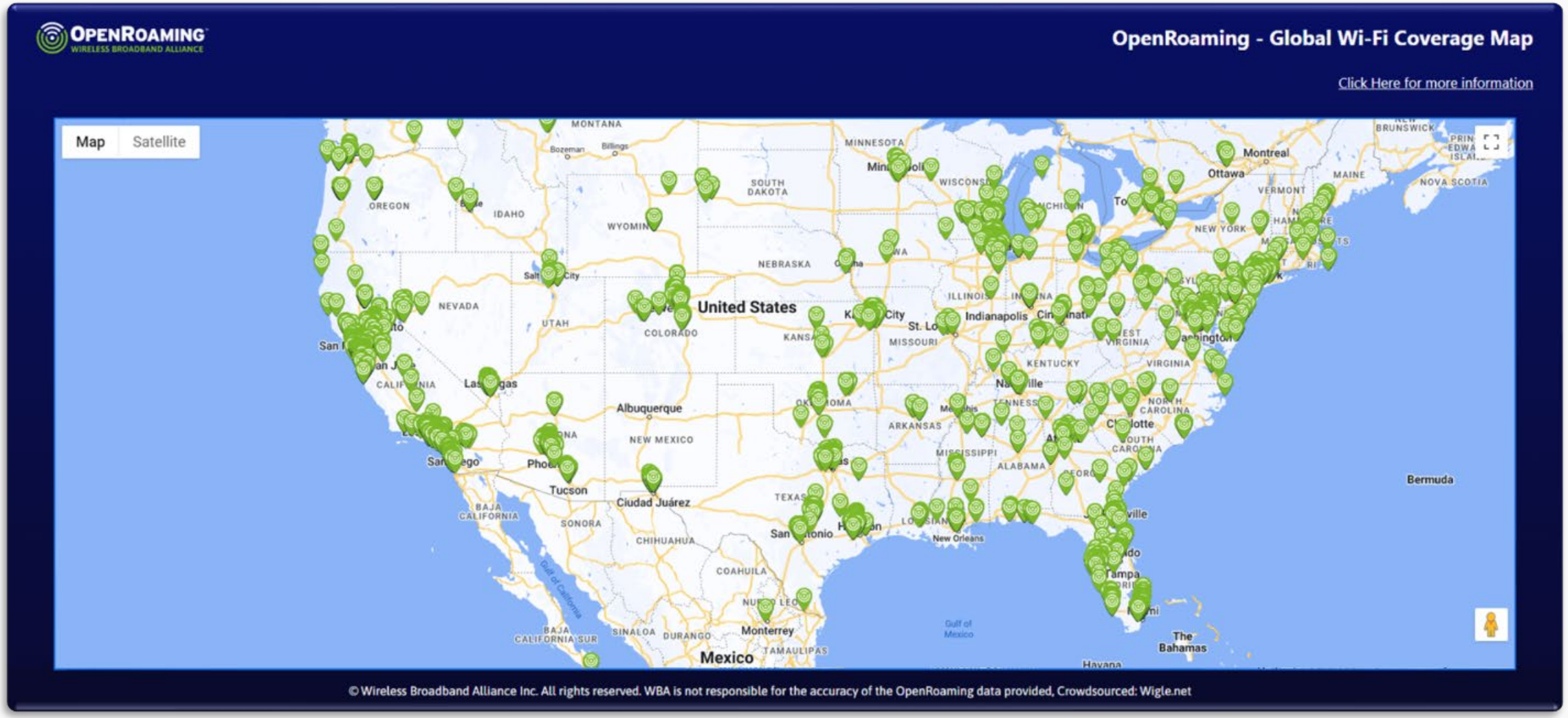
OPENROAMING PROFILE

Federated Onboarding Service (FOS Group) deliverable - Portal for OpenRoaming credential download



https://connect.openroaming.org

OPENROAMING MAP



https://wballiance.com/openroamingmaps/

BE PART OF WBA

Wireless Broadband Alliance

"SEAMLESS AND INTEROPERABLE WI-FI SERVICES"

OpenRoaming-Passpoint in Public-Guest Wi-Fi

Convergence & Coexistence of Wi-Fi and Cellular

Next Generation Wireless Networks

JOIN WBA AND BE PART OF THIS REVOLUTION

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I 

WI-FI

Wireless Global Congress Americas

Mike Finley

CEO, Boingo Wireless

CONVERGENCE IN ACTION

Connecting North America's Largest Infrastructure Projects

boingo wireless

CONVERGENCE IN ACTION

Connecting North America's Largest Infrastructure Projects

WBA Wireless Global Congress

June 12, 2024

Connectivity is the Backbone of Modern Transportation

”The integration of 5G/LTE technologies into the transportation ecosystem marks a paradigm shift in how our world moves. It’s no longer just about reaching from point A to point B; it’s about how efficiently, safely and intelligently we can achieve that transit.”

- 5G and Smart Transportation Report by TeckNexus

70%

of New York commuters use email/SMS/IM during their commute

79%

of New York commuters rely on travel-related apps to plan their commute

75%

of New York commuters access the internet via smartphone

1.6

hours is the average time New Yorkers spend commuting each day

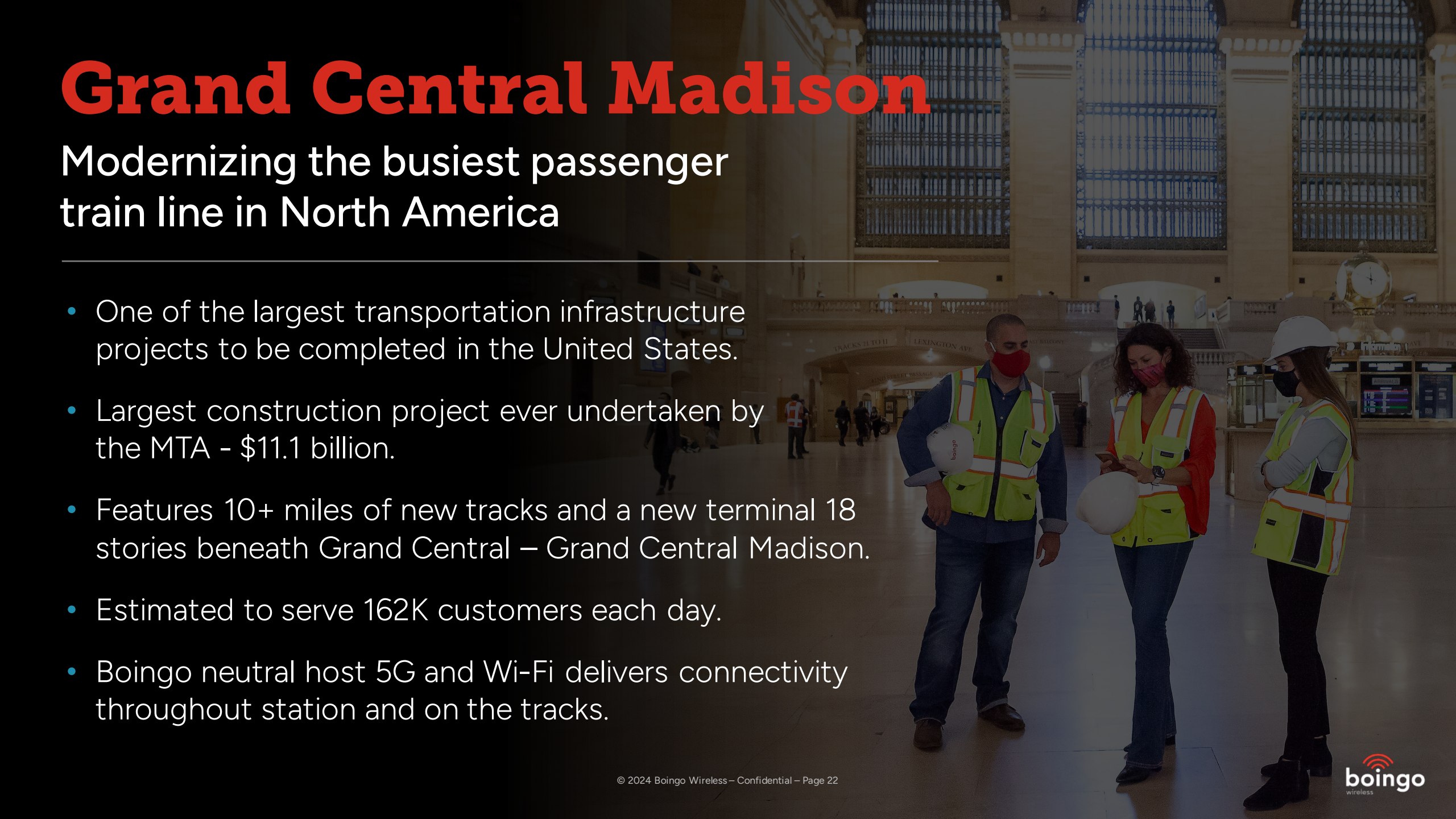
https://tecknexus.com/5gresearch/5g-in-smart-transportation/
https://mb.cision.com/Public/15448/2245329/bd73b23bdb92cee9.pdf

boingo wireless

Grand Central Madison

Modernizing the busiest passenger train line in North America

- One of the largest transportation infrastructure projects to be completed in the United States.
- Largest construction project ever undertaken by the MTA - $11.1 billion.
- Features 10+ miles of new tracks and a new terminal 18 stories beneath Grand Central – Grand Central Madison.
- Estimated to serve 162K customers each day.
- Boingo neutral host 5G and Wi-Fi delivers connectivity throughout station and on the tracks.



Boingo Behind the Scenes

100+
miles
of cable

100s
of APs

3 MILLION
square feet
of networking

JAMAICA STATION

Fourth-busiest rail station in North America

Weekday riders exceeds 200,000

Boingo converged 5G & Wi-Fi networks modernize this 100+ year old station

Riders can use mobile tickets, stream entertainment and stay connected to work while in transit

18 MILES

Coverage of Boingo's between Atlantic Terminal and Jamaica Station.

ATLANTIC TERMINAL

Long Island Rail Road's third largest terminal. First opened in 1877.

Vital connection point for commuters

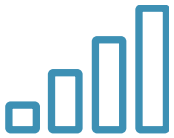
Boingo neutral host 5G and Wi-Fi delivers connectivity throughout station and on the tracks

Connectivity enables TrainTime app access for up-to-the-minute information on train schedules and platform changes.

boingo wireless

Leading Through Convergence

Meeting data demands and seamlessly supporting a vast diversity of devices and services.



Carrier cellular network

Improve cell service, eliminate dead zones and boost signal strength for all wireless carriers with distributed antenna system (DAS), small cell and tower solutions.

Private 5G network

From point-of-sale systems and fleet diagnostics to smart utilities, power IoT and critical devices with a dedicated, segmented network.

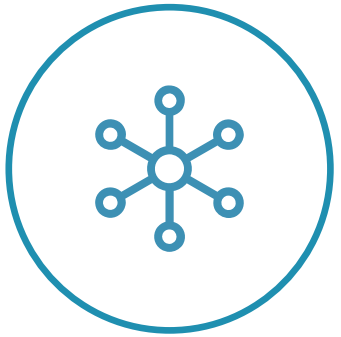
Enterprise Wi-Fi

Provide riders and staff with super-fast connectivity for mobile apps, streaming and internet browsing.

boingo wireless

Realizing the WBA Vision

Seamless, secure and interoperable connectivity



Collaboration among carriers, service providers, technology companies, cities and enterprises

Advocacy, trials and certifications

Eye on the future

boingo wireless


THANK YOU
Mike Finley
CEO, Boingo Wireless
boingo
wireless

Wireless Global Congress Americas

Dr. Sarper Gokturk

Vice President Innovation, Airties

Managed Home Wi-Fi: Keys to Successful Integration

Managed Home Wi-Fi

Keys to Successful Integration

Dr. Sarper Gokturk, VP of Innovation

Airties - Who We Are

With 20 years of Wi-Fi expertise, Airties is the trusted partner of broadband operators worldwide

Driving principles

Broadband operator focus: We focus solely on the ISP segment, helping them improve consumer satisfaction and monetize VAS

Industry standards: Our portfolio is based on recognized standards; Wi-Fi EasyMesh™, Wi-Fi Alliance, RDK, Wireless Broadband Alliance and prpl Foundation

Hardware agnostic: Airties software can be ported onto any gateway or STB – already integrated on approximately 120 CPE platforms from all major OEMs

Open API approach: We integrate with strategic partners to deliver a full range of connected home services

Privacy first: We manage the home Wi-Fi experience in compliance with strictest data privacy regulations

1.2B
Devices managed to date by Airties Cloud

20
Years perfecting Wi-Fi technologies

120 ~
Different CPE platforms integrated

40+
Wi-Fi related patents

400+
Employees of 20 nationalities

80%
Employees in R&D

HQ
in **Paris / France**
Board/Sales/Marketing

Backed
by Providence Private Equity Partners

Vast experience in 3rd party platform integration

Standard architecture and close partnerships mean faster and smoother rollouts

More than 120+ OEM product integrations

AT&T, COMMSCOPE, ALTRAN, NOKIA, HUMAX — * 6+ platforms

RDK — altice, ubee, Sagemcom — * 5 platforms

vodafone — vantiva, SERCOM, COMMSCOPE, Sagemcom — * 15+ platforms

EasyMesh™, RDK — Deutsche Telekom — vantiva, arcadyan, Sagemcom — * 5+ platforms

EasyMesh™ — proximus — vantiva, Sagemcom — * 10 platforms

COX — vantiva — *CBRv2 RGW *Air 4980

SKY — * 9 platforms

Telia Company — vantiva, Sagemcom — * 5+ platforms

EasyMesh™ — Telstra — vantiva, arcadyan — * 12 platforms

EasyMesh™ — bouygues — Sagemcom — * 4+ platforms

Deployments with all major Wi-Fi chipsets

Qualcomm, MEDIATEK, BROADCOM

Advanced engagement with leading **Wi-Fi 7** chipset vendors

Integration of **EasyMesh™** stack & extensions

Validation using **Airties ORBIT** test infrastructure

Distribution as part of **standard chipset vendor SDK**

Quantenna, REALTEK, Celeno, ON, RENESAS, intel, MAXLINEAR

Airties Portfolio is Founded on Industry Standards

Accelerates time-to-market and innovation

Operator-Managed Wi-Fi

Airties leads the WBA workgroups on **Operator Managed Wi-Fi reference architecture** and **End to End QoS**

Wi-Fi EasyMesh™ as well as TR-369 / USP are central to this architecture

EasyMesh™

Airties supports the adoption and evolution of **Wi-Fi EasyMesh™**, also working with the WFA for extensions to **Data Elements**

Airties **pre-integrates** and validates EasyMesh™ support with OEMs and chipset vendors

Broadband

Airties contributed and maintains the open-source EasyMesh™ controller component in **RDK-B**

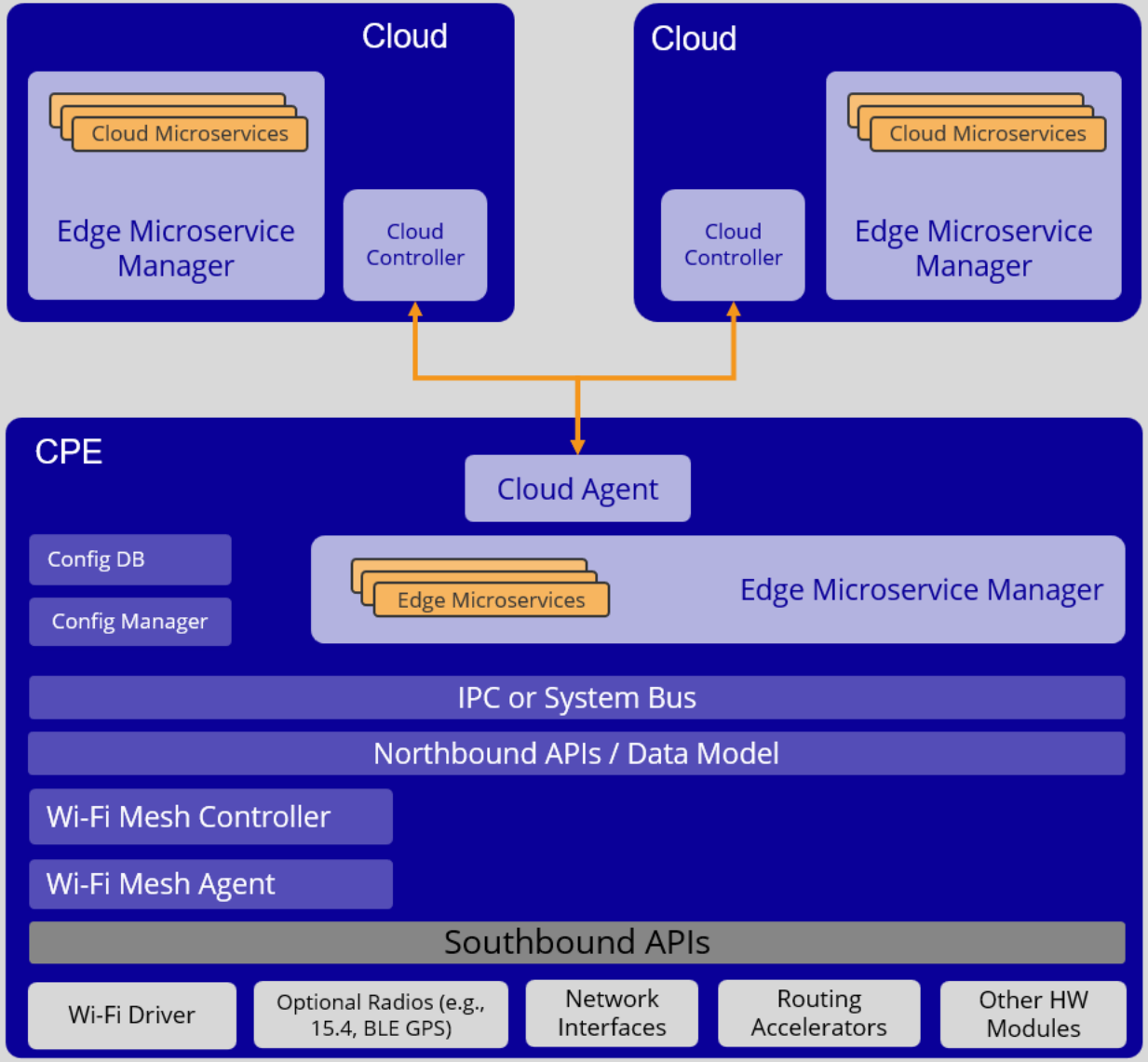
prplOS has emerged as an alternative CPE middleware option to RDK

Airties is contributing to a new set of common **northbound APIs** for both RDK and prpl

WBA OMWi

Operator Managed Wi-Fi Reference Architecture

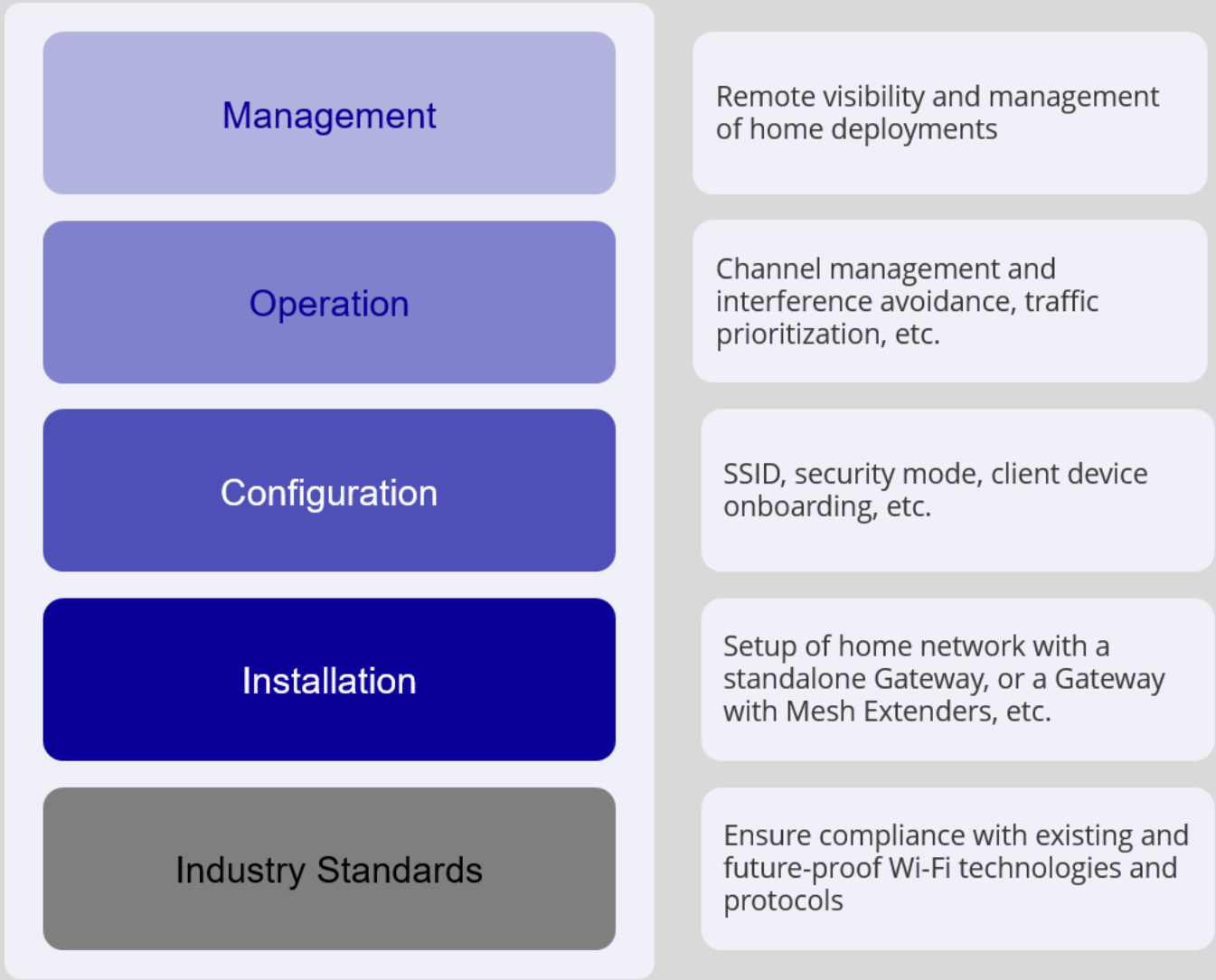
- Industry standards-based components and functions, e.g., TR-181, TR-369 (USP), WFA EasyMesh, WFA Data Elements.
- Common standardized components allow for modular architecture
- Reduced integration cost and effort, accelerating time-to-market
- Facilitates quick and easy deployment and maintenance of innovative value-add services
- Exemplary implementations available by prpl and RDK-B



WBA OMWi

Accelerates time-to-market and innovation

- Remote management capabilities enabling pro-active and reactive troubleshooting
- Easy installation and maintenance
- Future-proof architecture to embrace both old and new Wi-Fi technologies and protocols
- Remote data collection and management capabilities as enablers for data-hungry AI-driven value-add services
- Liaison and collaboration with WFA and BBF



OMWi – What's next?

Reference Architecture for Operator Managed Wi-Fi

Wireless Broadband Alliance OMWi

Phase 1

First release of the OMWi Reference Architecture whitepaper

OMWi demo at WGA Americas meeting at Las Vegas

Wireless Broadband Alliance OMWi

Phase 2

Extension of the OMWi features and new Wi-Fi standards and protocols

Simplification of the architecture embracing global open-source implementers

prpl RDK

Whitepaper v2.0 will be released this year

Wireless Broadband Alliance OMWi

Phase 3

Additional features, such as OpenRoaming, AFC.

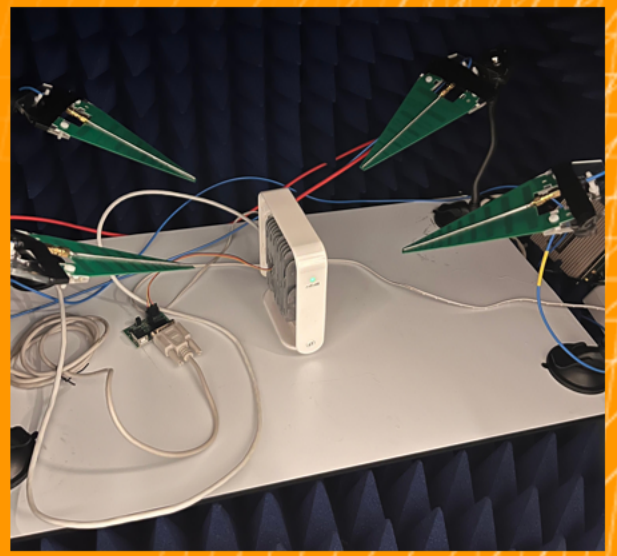
Testing and Certification for common standards-based components and functionalities

Whitepaper v3.0 release

Airties Orbit

Automated Data Verification Tool for measurability and repeatability

- Reduces validation timelines for integration projects
- An automated edge data verification tool using state-of-the-art Wi-Fi equipment
- Airties Orbit allows pre-validation of test data, **ensuring all parties of the integration project are in sync**
  - Reduces data verification to 3 days
  - Easily customized for any hardware platform
  - Supports Wi-Fi 6 | 6E | 7, dual-band & tri-band gateways and extenders
  - Standardized test plans with automatic report generation
- Airties Orbit frees up resources for innovation and has already been adopted by chipset partners, OEMs and service providers



Benefits of Airties Orbit

Advantages for OEMs, chipset manufacturers, and broadband service providers

High accuracy, avoiding manual execution errors

Allows self-certification for ISPs

Compatible with open-source RDK or prpl architecture

Easy reproduction of issues to pin-point source

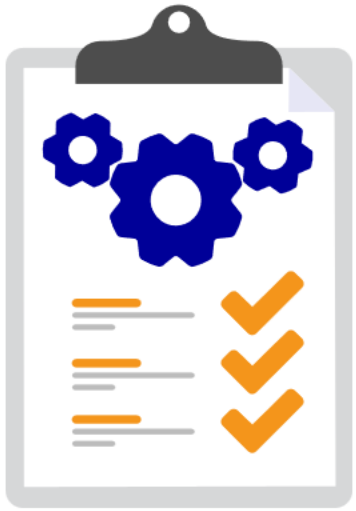
Simplifies new firmware updates

Remote data verification

7 times faster vs. manual

What is it we all need?

Simplification, time-to-market & innovation

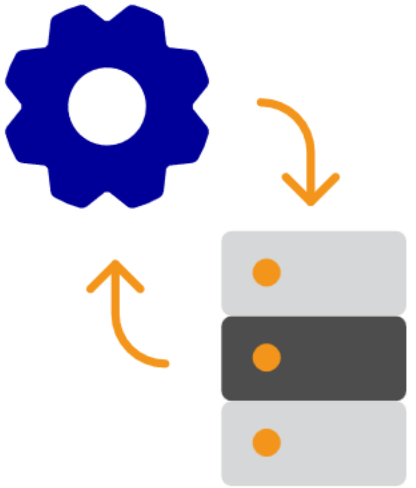


Standards-Based

Interoperability
Easy to remake

Open-Source SW

Community /
Collaboration



Applications & Data

Services /
Innovation

Thank You

Come see our demos at table #7

Wireless Global Congress Americas

Eric McLaughlin

Vice President, Client Computing Group, General Manager, Wireless Solutions Group, Intel Corporation.

Wi-Fi 7 and AI PC Connectivity Innovation

Wireless Broadband Alliance: WGC Americas 2024

Wi-Fi 7 & AI PC Connectivity Innovation

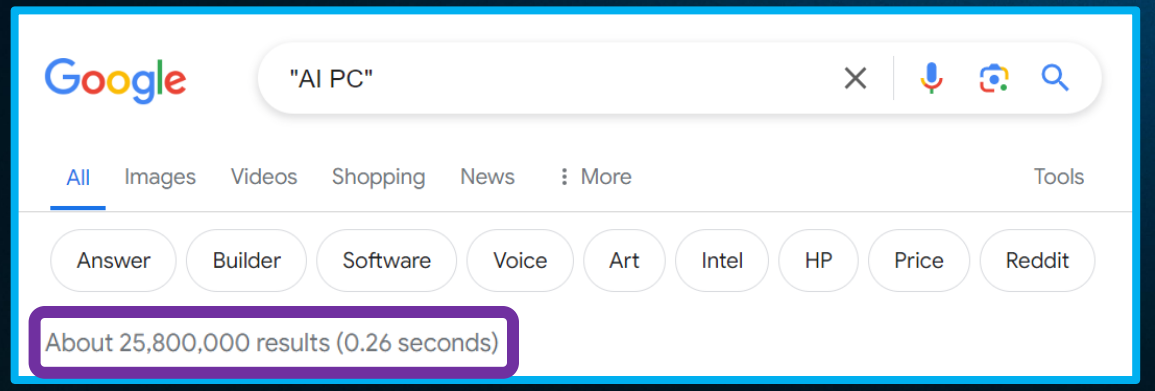
Eric A. McLaughlin
Vice President, Client Computing Group
General Manager, Wireless Solutions Group

June 12, 2024

Welcome to the AI PC Era!

AI PC Experiences

- Local AI PC
  Data / Hardware / Software
- Private / Confidential
  Data Protection

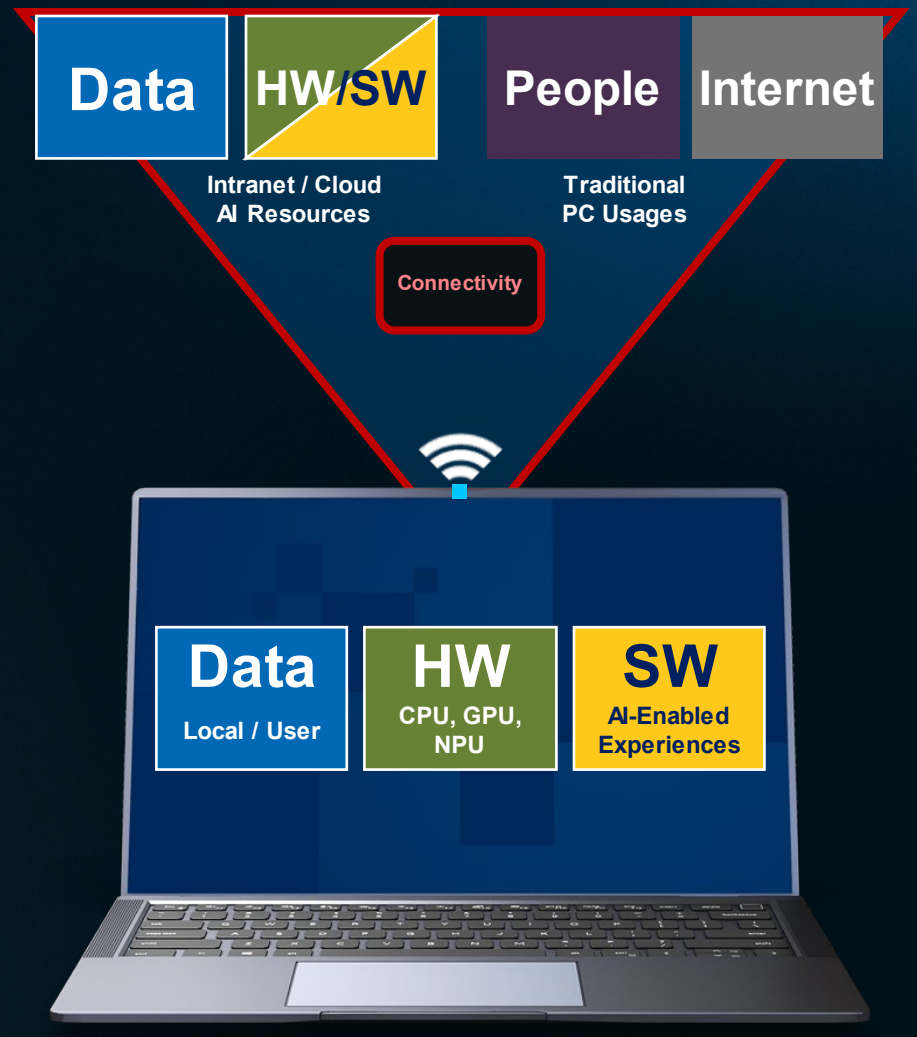


Connectivity is Essential for AI PCs

AI PCs enable…

- Local AI - PC processing & acceleration
- Hybrid AI - External data & AI resources
- Traditional connected PC usages

The right connectivity solution is required



Premium Connectivity - Improves AI PC Experiences

Data Type	Real-Time/Bursty Data Processing	Smooth/Continuous Data Processing	Cloud/Networked Data Processing	Large Dataset Processing
Workload Examples	Interactive AI Media/Gaming AI-Enhanced Video Collaboration AI-Voice Recognition/Translation	AI-Enhanced AR/VR/XR High-Definition AI Media Live Video Analysis	Complex Media Editing Advanced 3D Modeling	AI Models, Predictive Analytics Cybersecurity/Healthcare AI Engineering/Aerospace AI Business/Financial/Operations AI
Poor Connectivity	**AI Computation Errors; Potential Data Loss; Laggy/Glitchy Experiences**			
Premium Connectivity	**Low Latency/High Reliability; Accurate/Responsive Output; Smooth/Immersive Experiences**			

Premium Connectivity for AI PCs

Hybrid AI PC experiences can involve…

- Massive data sets, data streams, and high-definition files
- Complex, real-time computations
- Need for consistent, near-instantaneous data access

Connectivity transports data in/out of the platform

1 **Premium Connectivity - Delivers the performance needed for great AI experiences**
(Extreme high speed, low latency, and deterministic reliability)

Example: Intel® Wi-Fi 7 (5 Gig)

- Up to 5 Gbps max data rates
- Up to 60% lower latency vs. typical Wi-Fi 6
- Multi-link operation reliability

Connectivity Generates Lots of Client/Network Data

② Data - Intel® Wireless Solutions can capture & share connectivity and other actionable real-time platform information

Examples:

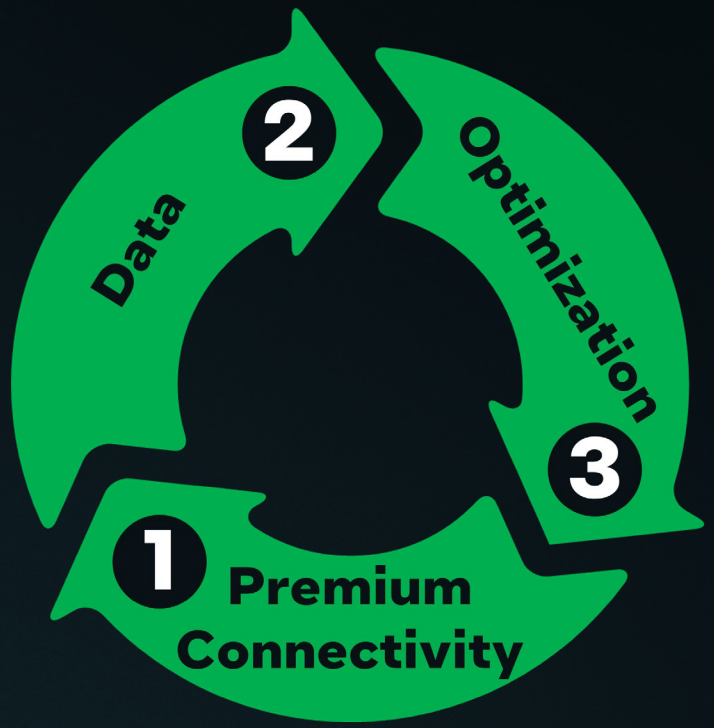
- Network environment
- Configurations/settings
- Connection details/metrics
- Application/workload traffic details
- And more…

Connectivity Performance Optimization

3 Optimization - AI-based connectivity software can improve client and network performance based on real-time data insights

- Client: Intel® Killer™ Networking Software & Intel® Connectivity Performance Suite
- 3rd Party: Intel® Connectivity Analytics Program

AI PC & Intel® Wi-Fi 7 (5 Gig): A Positive Feedback Loop



Intel is positioned to help accelerate the AI PC transition

- Platform/connectivity: leadership, synergies, innovations
- Influence/engagements: industry, OEMs, developers, partners

Future: Connectivity-Powered AI Experiences

Wireless Human Presence Detection & Secure Authentication

High-precision Wireless Gesture Recognition & Directionality

AI PC

Wi-Fi Sensing & Peer-to-Peer sharing are just the beginning

Wireless Health Monitoring Real-time Telemedicine

Adaptable AI Thunderbolt™ Wired Docking & Devices

Contextual awareness and AI will define an inflection point in connectivity capabilities beyond communications

Closing Thoughts

- We're excited about the potential global impact of AI PCs
- AI experiences will rely on multiple sources of data/processing and great connectivity
- The future of connectivity will evolve with context-aware AI experiences
- Industry and ecosystem collaboration is needed for continued AI innovation
- The efforts of the WBA AI/ML workgroup will be critical

Let's continue to work together
to help accelerate the ramp of Wi-Fi 7 and AI PCs

THANK YOU!

For more information, please visit:
www.intel.com/wireless, www.intel.com/ica-program

Notices & Disclaimers

6 GHz laptop functionality requires Intel® Wi-Fi 6E/7 products, Wi-Fi 6E/7 APs/Routers/Gateways, and Operating System support, along with country-specific 6 GHz spectrum allocation for non-licensed use and associated regional regulatory approvals. 6 GHz may not be available in some countries.

While Wi-Fi 7 is backward compatible with previous generations, new Wi-Fi 7 features require PCs configured with Intel Wi-Fi 7 solutions, PC OEM enabling, operating system support, and use with appropriate Wi-Fi 7 routers/APs/gateways.

Wi-Fi 7 products can access 320 MHz channels in 6 GHz and new 160 MHz channel combinations in both 5 and 6 GHz with new Multi-Resource Unit Puncturing capabilities.

Based on IEEE 802.11be draft specification, the maximum theoretical data rates for 2-stream devices that support 320 MHz channels and 4K QAM is 5.8 Gbps.

Intel engineering simulations of congested network environments indicate major latency reduction is possible with new Wi-Fi 7 Multi-Link Operation capabilities.

Intel is committed to protecting individual's privacy. For additional information, please refer to Intel's Privacy Notice.

All product plans and roadmaps are subject to change without notice.

Statements in this document that refer to future plans or expectations are forward-looking statements. These statements are based on current expectations and involve many risks and uncertainties that could cause actual results to differ materially from those expressed or implied in such statements. For more information on the factors that could cause actual results to differ materially, see our most recent earnings release and SEC filings at www.intc.com.

For additional details, please visit www.intel.com/performance-wireless

Performance varies by use, configuration, and other factors.

No product or component can be absolutely secure.

Intel technologies may require enabled hardware, software, operating system, or service activation.


intel

Wireless Global Congress Americas

Matt MacPherson

CTO Wireless, Cisco.

Future Wireless. New Technologies for the Next Generation of Applications.

Future Wireless

New technologies for the next generation of applications

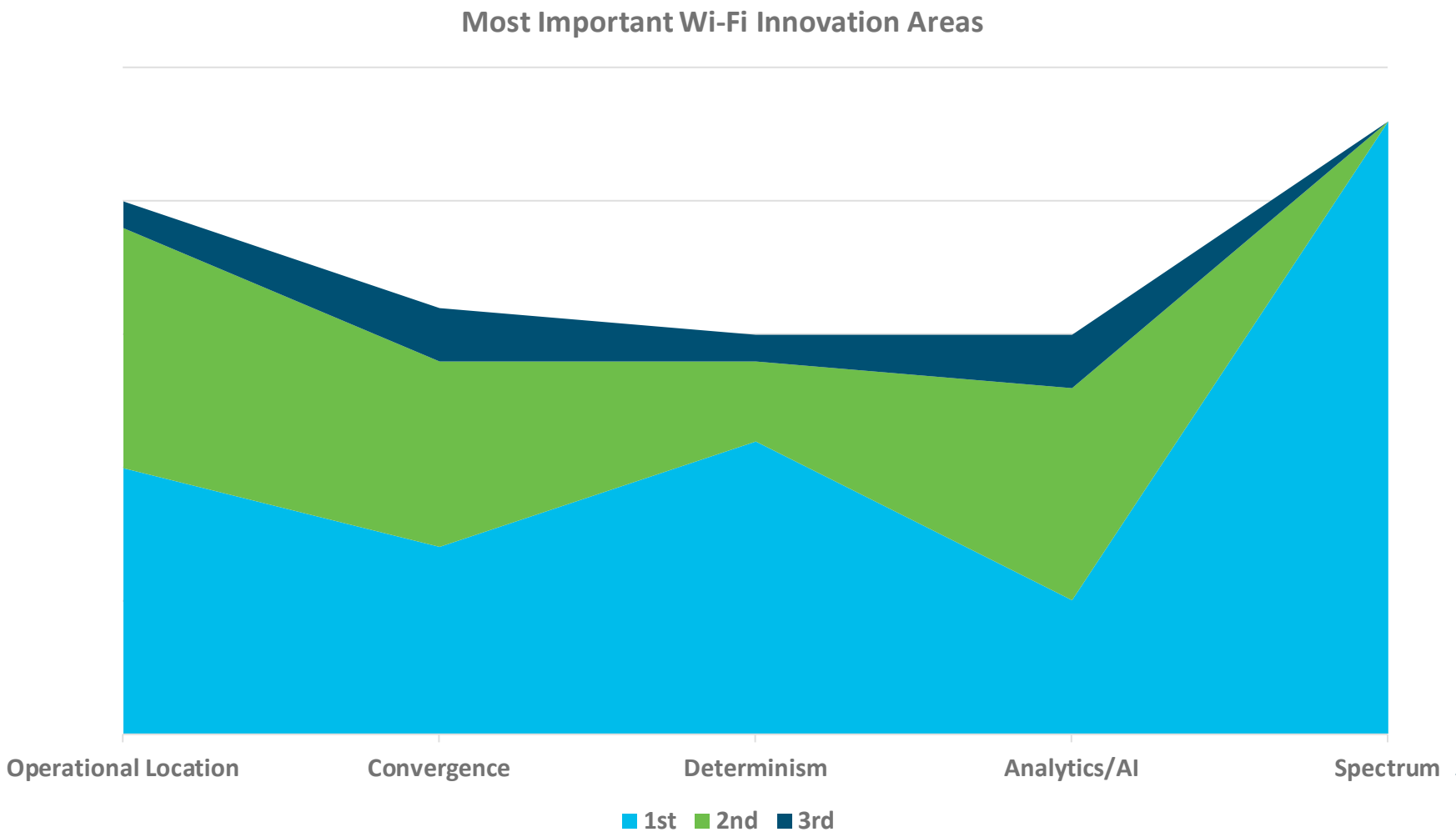
WBA Wireless Global Congress
Matt MacPherson
Wireless CTO, Cisco

June 2024

The mind of a Wireless CTO

*EE – Enterprise Everywhere

…and customers say…



Can we achieve…

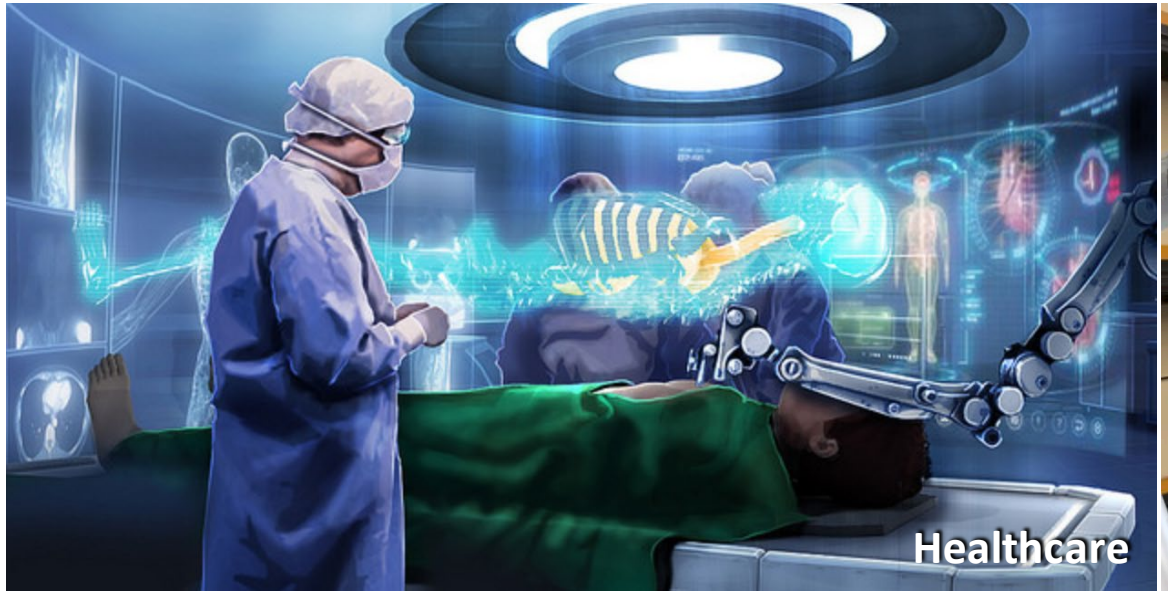
Deterministic Wi-Fi??

QoS (OCE QoS Mgnt, L4S)

Wi-Fi 7/8 (SLAW, MLO, Puncturing)

Deterministic Mission Critical Wireless

High Bandwidth, Low Latency at Scale

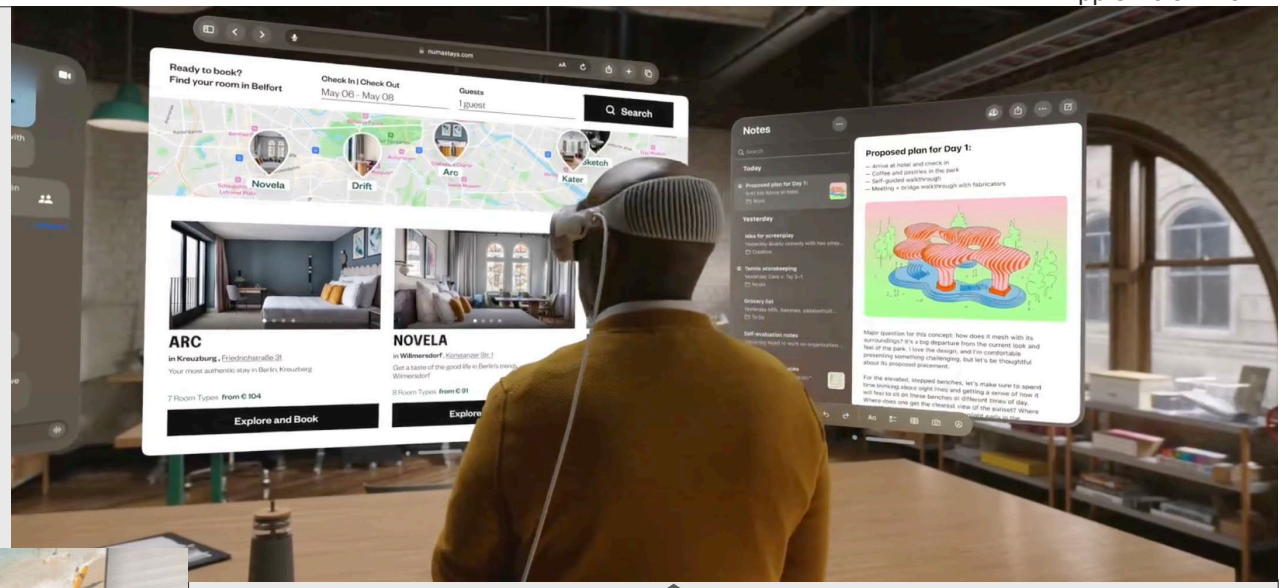


Determinism in the Enterprise

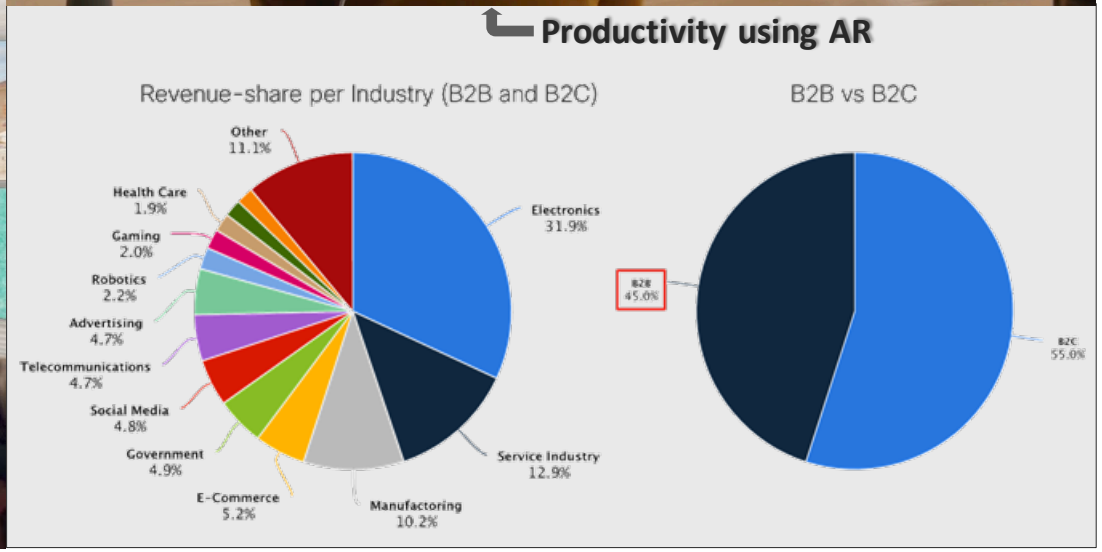
Education

Collaboration using MR

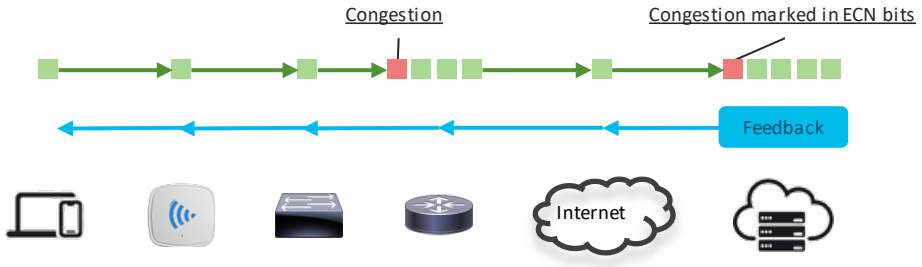
Apple Vision Pro™



Productivity using AR

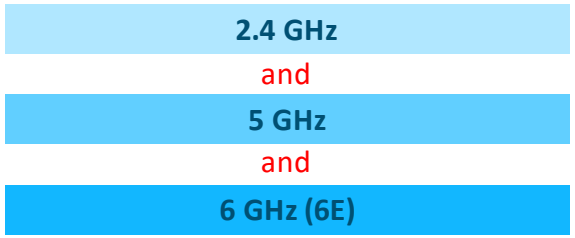


Key technologies that enable determinism



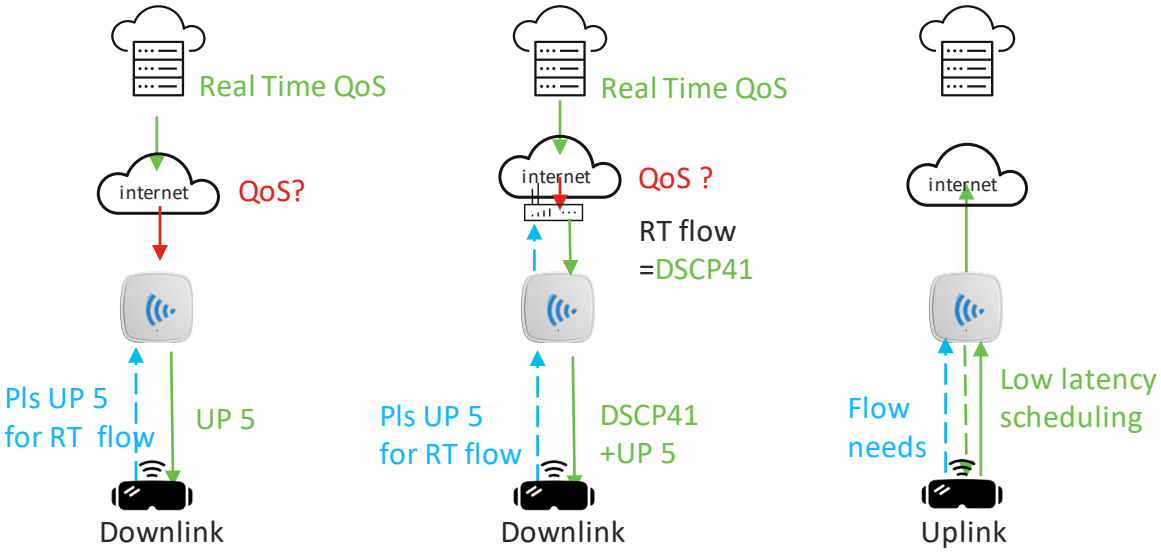
Low Latency Low Loss Scalable Throughput (L4S)

MLD Capable



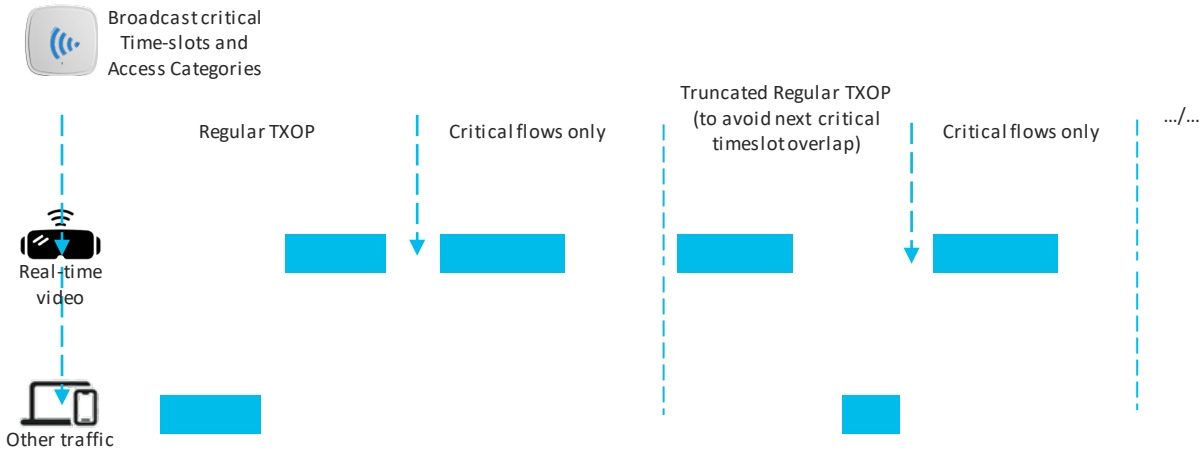
Wi-Fi 7 with MLO

MLD Capable



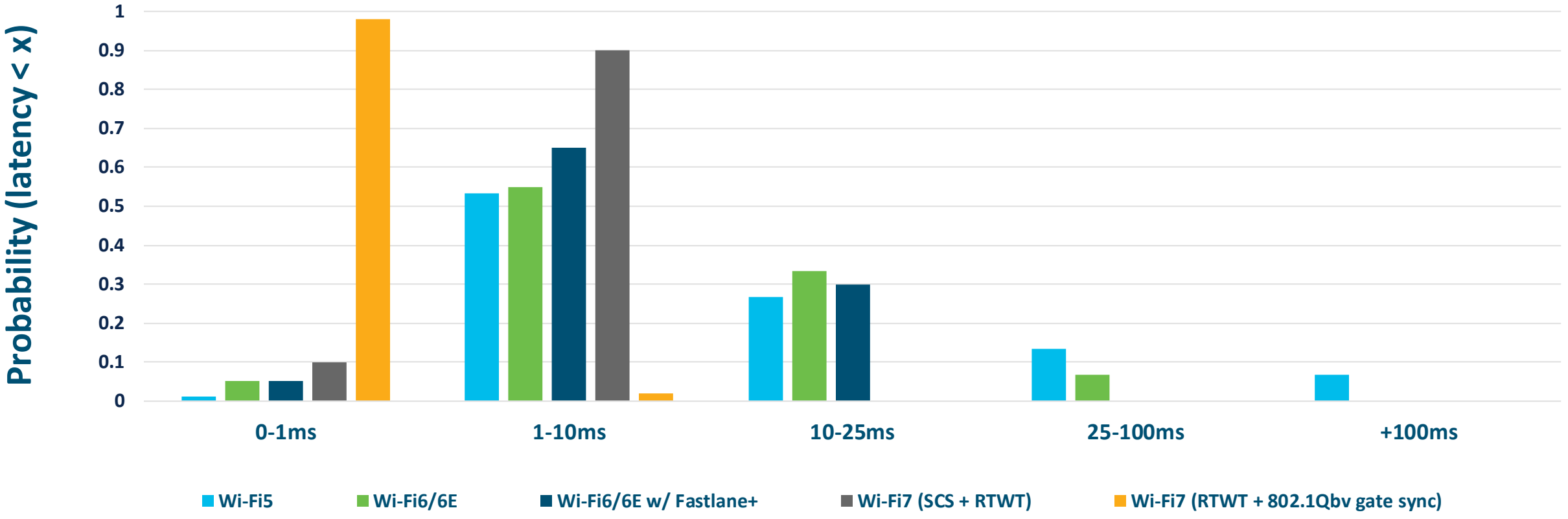
UP = User Priority

Wi-Fi 7 SCS



Wi-Fi 7r2 with Restricted-TWT

Path to Deterministic Latency & High Reliability



Bounded Latency – even in high-traffic scenarios!

Source: https://mentor.ieee.org/802.11/dcn/22/11-22-0634-00-00be-802-11be-enhancements-for-tsn-time-aware-scheduling-and-network-management-considerations.pptx

Can we achieve…

Convergence??

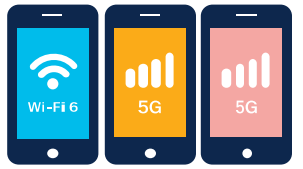
QoS (OCE QoS Mgnt, L4S)

Wi-Fi 7/8 (SLAW, MLO, Puncturing)

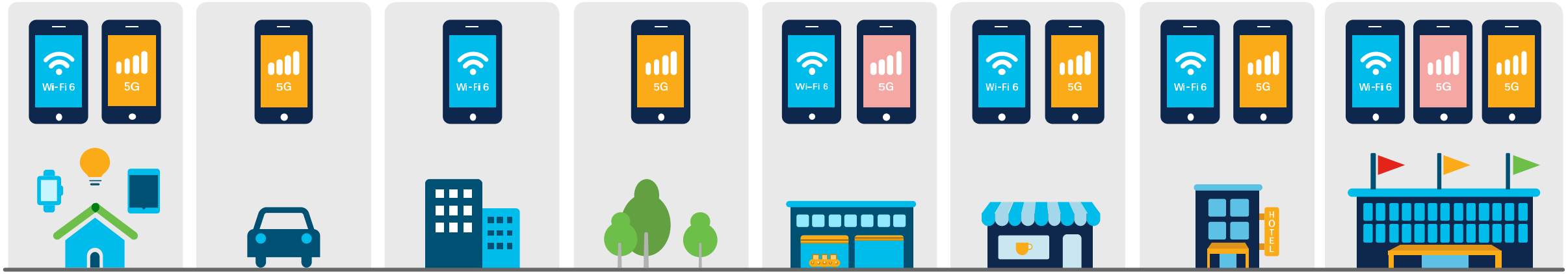
Converged Multi-Access Wireless

Policy-based seamless roaming across enterprise and service provider

Converged Access for People and Things



WiFi6 5G Private 5G



Home | Driving | Corporate office | Customer call in the car | IIoT & Healthcare | Coffee shop | Hotel | Football match

To use all stacks better, we need…

Frictionless Onboarding

OpenRoaming for all stacks
(assure access to all available paths)

Seamless Interworking

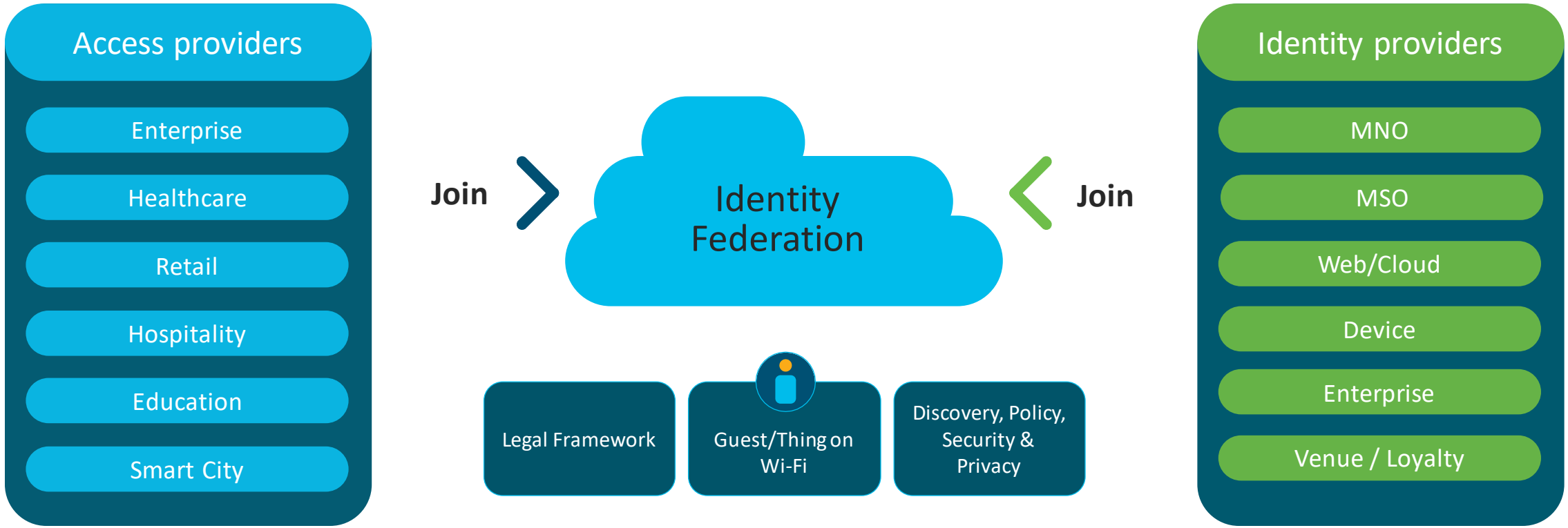
Policy-based path selection for
Loosely coupled Access Networks

Seamless Handover

Roaming between Wi-Fi (private)
and cellular (public)

OpenRoaming – Connecting Everywhere!

Opening the Wi-Fi Ecosystem to new experiences & business models



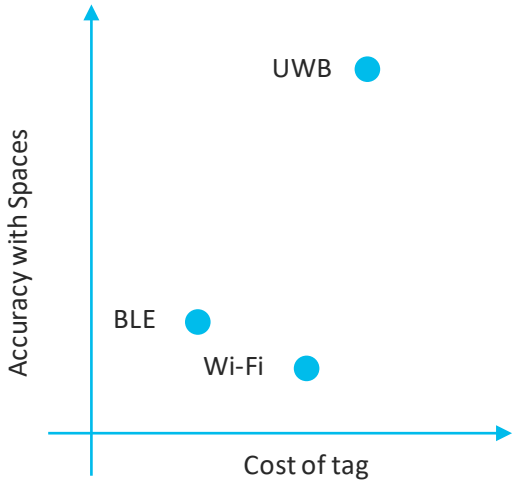
OpenRoaming is a federation of identity & access providers to enable seamless roaming & onboarding

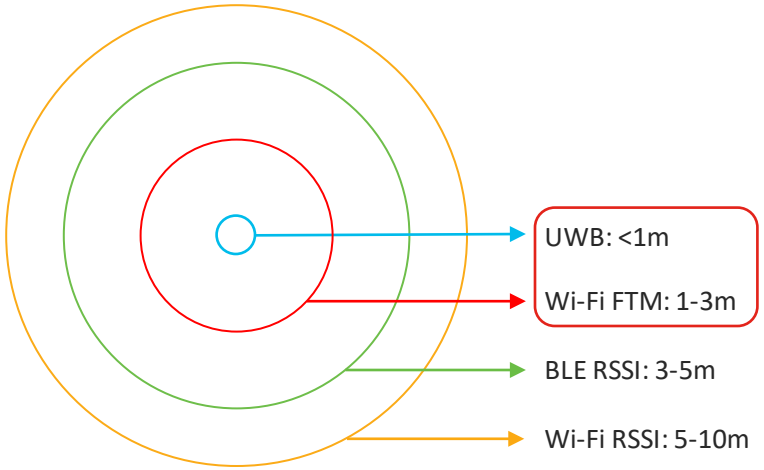
Advanced Location with FTM/UWB

+

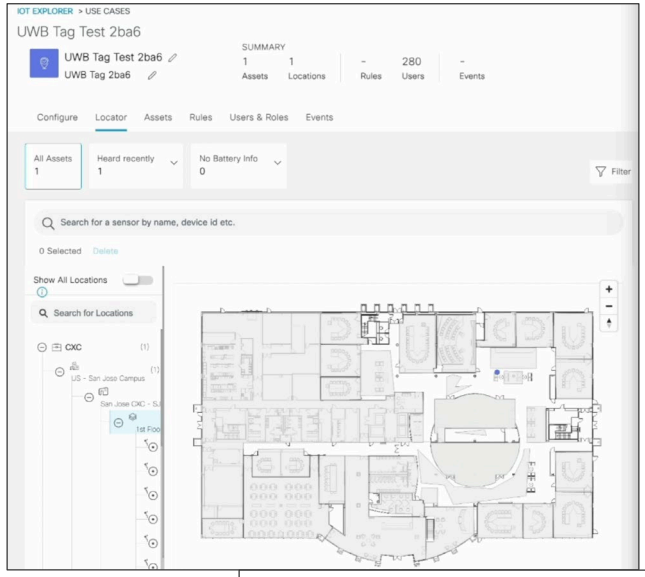
=

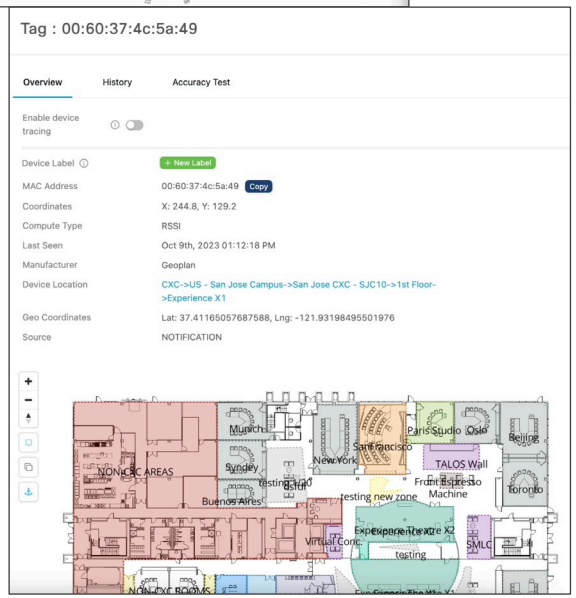
Wi-Fi
BLE
UWB
All in one





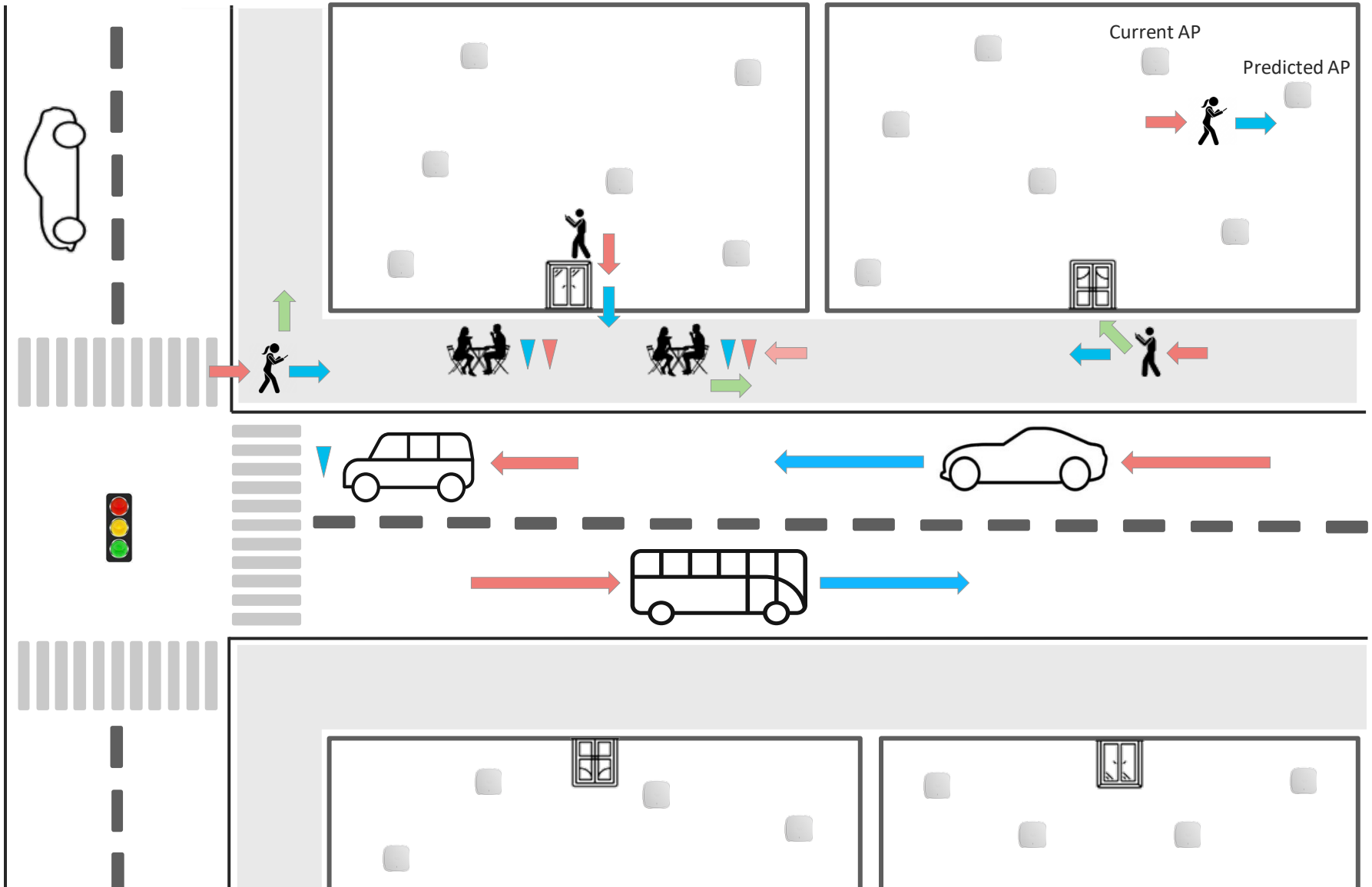
Accuracy Comparison

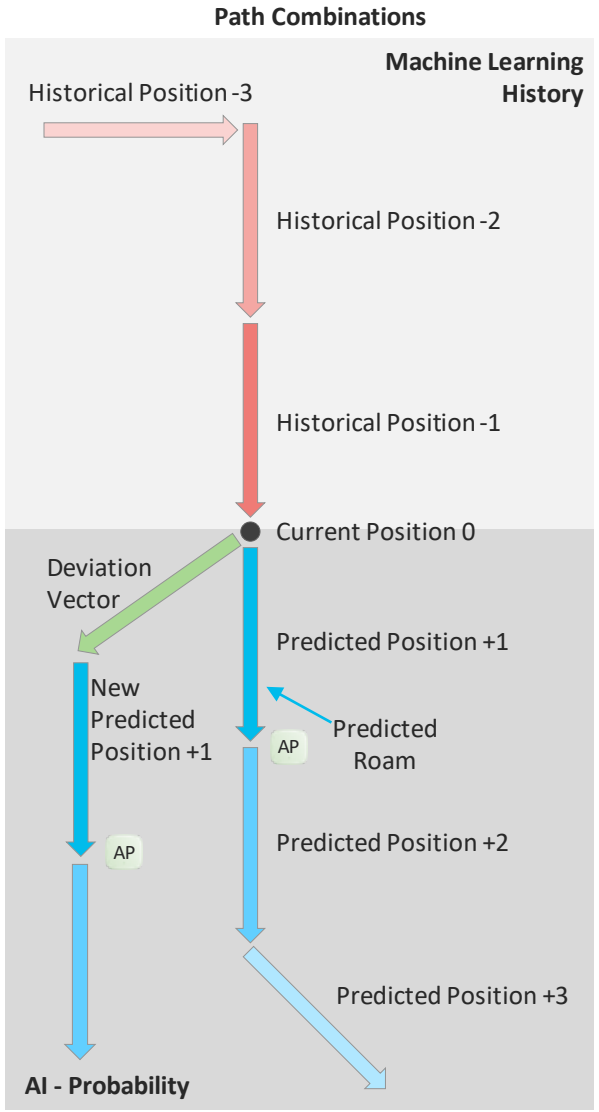




Seamless handover with Vector Roaming

Vector-based roaming: use STA movement vector to recommend APs and handoff






CISCO

Wireless Global Congress Americas

Operator Panel

JR Wilson

Vice President, Tower Strategy and Roaming, AT&T Services.
Chairman, Wireless Broadband Alliance.

Dr. Derek Peterson

CTO, Boingo Wireless.
Co-Chairman, Wireless Broadband Alliance.

Wireless Global Congress Americas

WGC AMERICAS

CONNECTING OUR DIGITAL WORLD

COFFEE BREAK & NETWORKING
BE BACK IN 25 MINUTES AT 11.15 AM CT

Wireless
Global Congress
Americas

Bruno Tomás

CTO, Wireless Broadband Alliance

Session Moderator

Wireless Global Congress Americas

WGC Americas Speakers

Manish Malhotra
AT&T

Kathi Yeager
JKL Group

Jack Raynor
Meta

Bart Giordano
RUCKUS Wireless

Kevin Robinson
Wi-Fi Alliance

Eric McLaughlin
Intel Corporation

Robert Stacey
IEEE

Wireless Global Congress Americas

Time	Presentation
11:15 AM (CT)	**Moderator Introduction** Bruno Tomás, CTO, Wireless Broadband Alliance.
11:20 AM (CT)	**Fireside chat - Spotlight on MDU** Manish Malhotra, AVP, Fiber Broadband Product Management and Development, AT&T; Kathi Yeager, JKL Group
11:35 AM (CT)	**TIP OpenLAN Accelerating Innovation** Jack Raynor, OpenLAN & OpenWiFi Group Chair, Meta.
11:55 AM (CT)	**Wi-Fi 7+AI – The Real Reason You WANT IT! NOW!** Bart Giordano, President Networking, RUCKUS Networks.
12:15 PM (CT)	**Wi-Fi Wi-Fi®: Driving Next-Generation Innovation and Impact for 25 Years** Kevin Robinson, President & CEO, Wi-Fi Alliance.
12:30 PM (CT)	**Panel: New Business Opportunities in the Wi-Fi 7 Era** Eric McLaughlin, Vice President, Client Computing Group, General Manager, Wireless Solutions Group, Intel Corporation; Kevin Robinson, President & CEO, Wi-Fi Alliance; Robert Stacey, Chair – 802.11 WorkGroup, IEEE.
1:00 PM (CT)	LUNCH & NETWORKING

Wireless Global Congress Americas

Fireside Chat: Spotlight on MDU

Manish Maholtra

AVP, Fiber Broadband Product Management and Development, AT&T.

JKL Group

Kathi Yeager

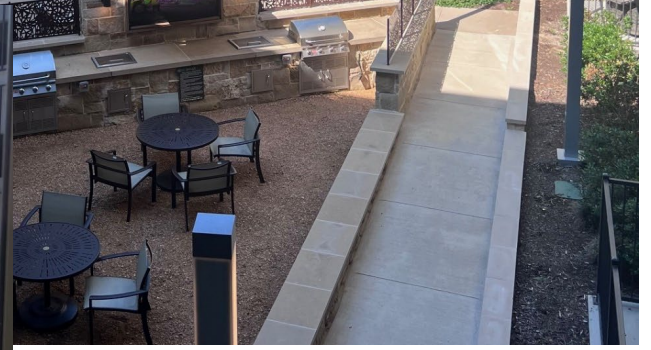
JKL Group

Watterscape Urban Residential

930 Rideview Drive

Allen, TX 75013


WATTERSCAPE
URBAN RESIDENTIAL

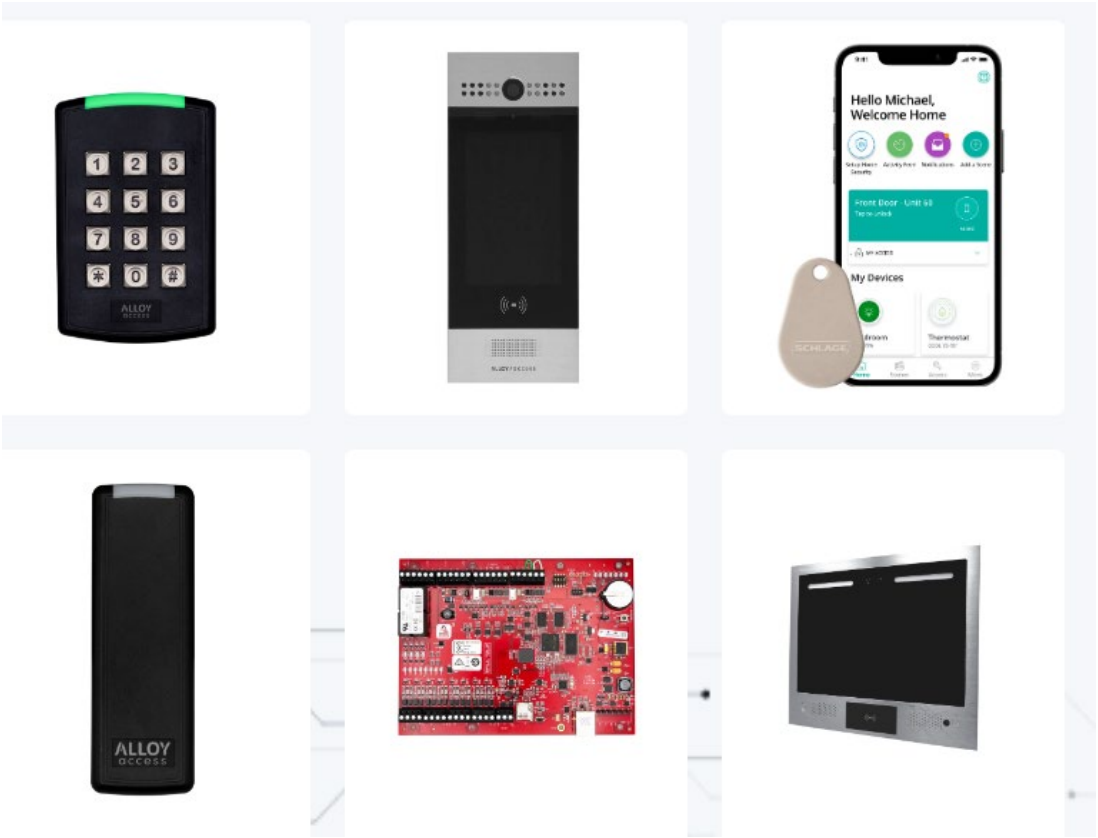


Courtyards

Watterscape WiFi community

Smart Homes

Access Control



Garage Areas


ALLOY


DELL Technologies


RUCKUS
ALLOY


RUCKUS

Thank you!

Watterscape Urban Residential

930 Rideview Drive

Allen, TX 75013

Watterscape Community WiFi

- Up to 1 Gbps Wired & Up to 400 Mbps Wi-Fi for each unit with 10 Gbps Uplink
  - Enhanced Performance Equipment for 10 Gbps Uplink Capability
    - Provides Improved Peak Busy Hour Performance
  - AP Location is Custom Designed for each Unit
    - Provide Optimal Wi-Fi Coverage for Various Living Unit
  - Supports Living Units, Common Areas and Parking Garage,
  - Courtyards, Walking areas around the building, Mail room,
  - Dog Run, etc.
- Public IP Per Account Supports:
  - Unrestrictive NAT for Cloud Gaming
  - VPN Work from Home Applications
- Multicast Functionality for Consumer Devices
  - Supports Sonos Speakers
  - Supports Apple IP Home Pods
  - Supports Enhanced Property Wide Wi-Fi Calling Service
  - Security/Fire Systems
  - Camera system throughout the property
  - TV's/Speakers throughout amenities
  - EV chargers WiFi requirements
- Supports Living Unit IoT Devices for Resident's Use
  - Automated and Remote Door Locks
  - Tstats, Leak Sensors, electric plugs
  - Automated and Remote Lighting Controls

Wireless Global Congress Americas

Jack Raynor

OpenLAN & OpenWiFi Group Chair, Meta.

TIP OpenLAN Accelerating Innovation

OpenWiFi™

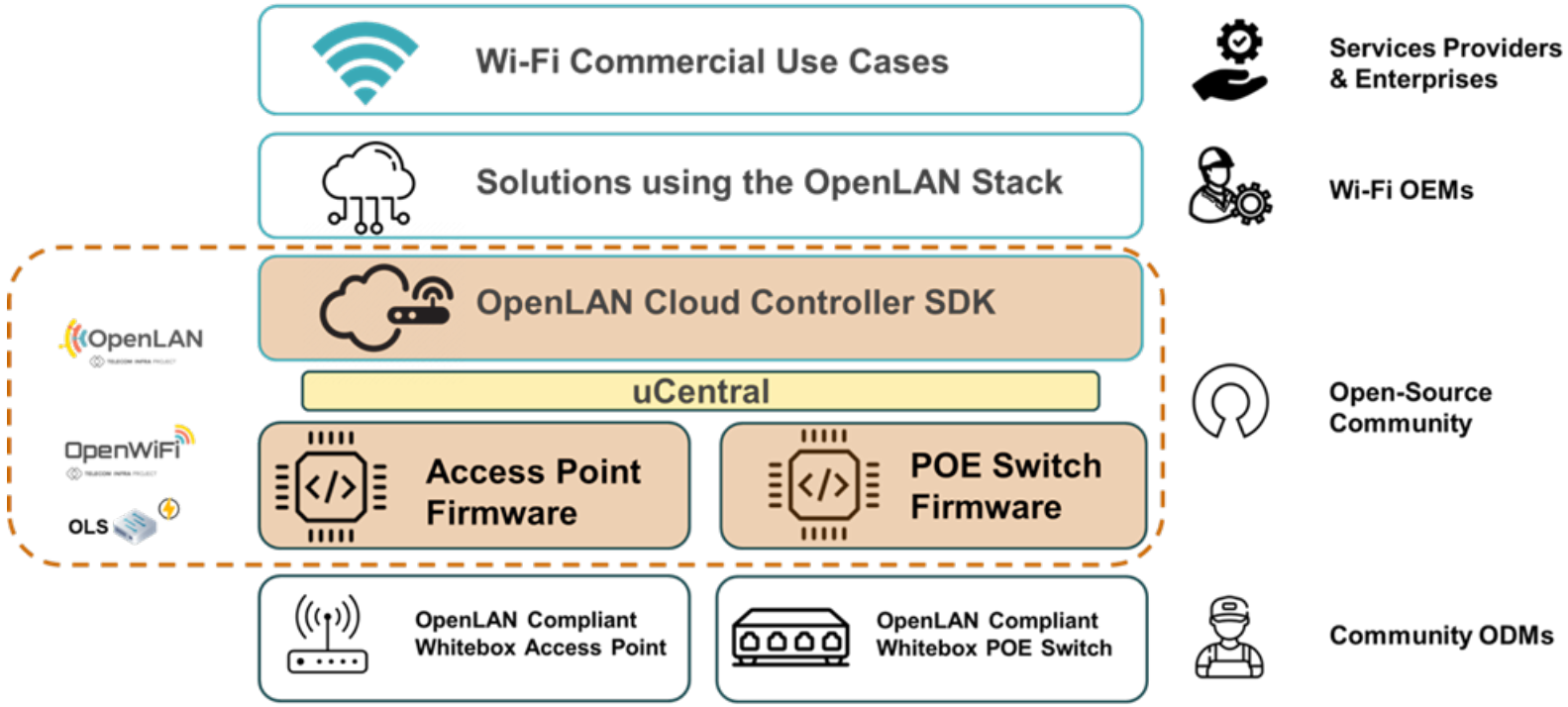
TELECOM INFRA PROJECT®

TIP OpenLAN Accelerating Innovation

Jack Raynor, Meta
OpenLAN & OpenWiFi Group Chair

TIP OpenLAN

What is TIP OpenLAN?



OpenLAN is a community-developed, disaggregated Wi-Fi software system, offered as free open-source software, that includes a **cloud SDK, Enterprise-grade Access Point (AP) firmware & Enterprise grade POE++ Switch firmware**, designed and validated to work seamlessly together.

TIP OpenLAN

Base Enterprise Wi-Fi is Now Table stakes!

Value Add

OpenLAN Based Products

Table Stakes

OpenLAN™

TELECOM INFRA PROJECT®

open source

OpenLAN: The Power of Community

Community Open To All
+
Collaboration
+
Transparency
+
Diversity
+
Full Feedback Loop
+
Community Member Growth
=

TIP OpenWiFi

OpenLAN: A Growing Ecosystem

Service Providers

COMCAST
Telefónica
COX
AT&T
Bell
intello by TELUS Business
T-Mobile
vodafone
LIBERTY GLOBAL
vodacom
orange
TIM
Rakuten Mobile
LIBERTY LATIN AMERICA

Chip Providers

Qualcomm
MEDIATEK
REALTEK
intel
MARVELL

Industry Standards

Wi Fi ALLIANCE
Wireless Broadband Alliance
IEEE Advancing Technology for Humanity
broadband forum

Hardware

CIG
Edge-corE NETWORKS
io by HFCL
SERCOMM
INDIO NETWORKS
inventum inventive continuum
LINDSAY BROADBAND a division of technetix group
Wallys (Suzhou) Communications Co., LTD
Asterfusion

Controllers

ARILIA
NetExperience
wavespot
SHASTA CLOUD
io by HFCL
Asterfusion
Edge-corE NETWORKS
INDIO NETWORKS
inventum inventive continuum
tanaza

ISPs/MSPs

ASK4 THE INTERNET AS IT SHOULD BE
PAVLOV media
SINGLEDIGITS
WORLDVUE
SPECTRA
ANDRENA
boingo
think a wifi company
ATLANCIS

Technology Partners

GoZone WiFi
globalreach
AMERICAN BANDWIDTH
SPECTRA
Candela TECHNOLOGIES
KINARA SYSTEMS
Saprecomm
EPITIRO
PLVISION Connectivity of Tomorrow
rgNets
Benison.

TIP OpenWiFi

Key Technologies

OpenWrt Based

Security, ZTP

uCentral Data Model

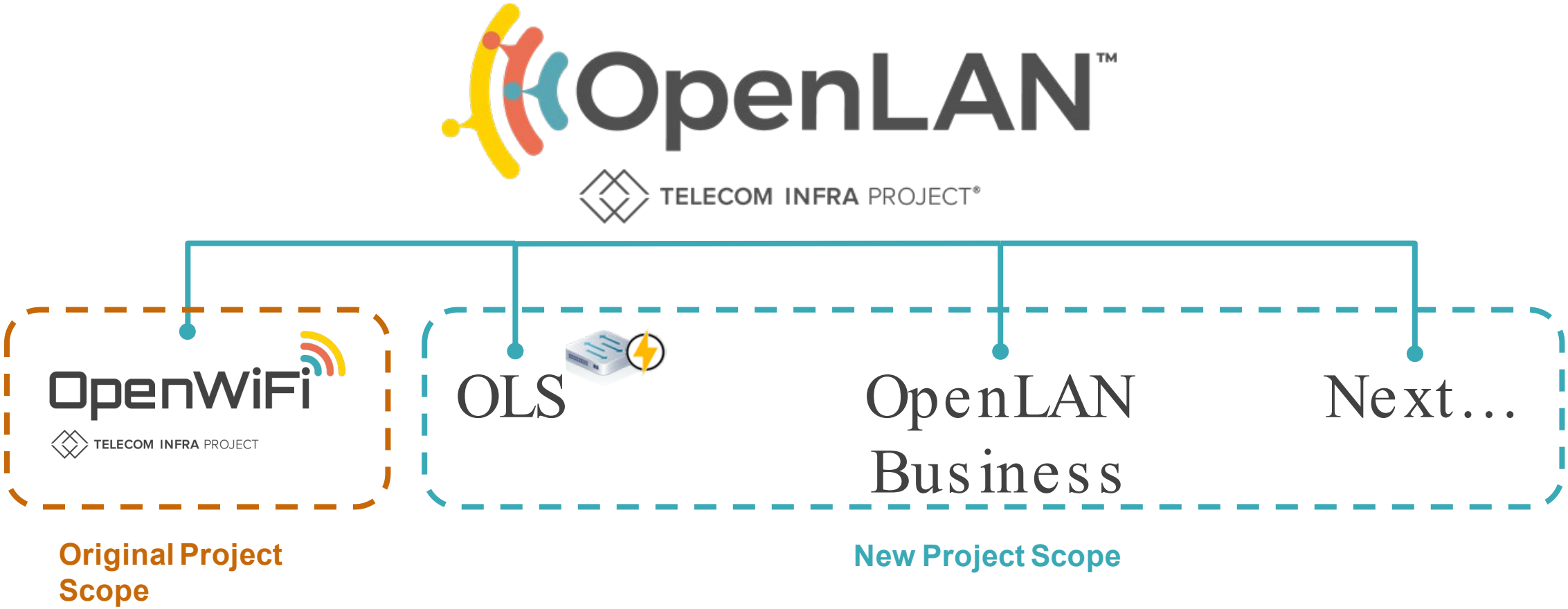
Cloud Native Controller

Open APIs

Streaming Telemetry

TIP OpenLAN

Community Driven Expansion!



Engineering Roadmap – 2024

HEALTH | Scope | Resources | Engagement | HW/SW Readiness | DATE Mar 2024 | OVERALL HEALTH

Cloud Software

Cloud 3.0.2 SDK
- OLS Schema Support
- DB Scaling Support

Cloud 3.1 SDK
- CW Horizontal Scaling
- OLS Device Management
- Device Fingerprinting

Cloud 3.2 SDK
- Device Fingerprinting
- CW Horizontal Scaling
- PKI – Lifecycle management

Cloud 4.0 SDK
- Topology Manager (TBD)
- AP Rogue Detection (TBD)

Cloud GW 1.0
- Community Lod

Cloud GW 1.1
- Base Parity with SDK – GW
- Topology Awareness

Cloud GW 2.0
- TBD

Device Firmware

APNOS 3.0.1 GA
- Bug Fixes

APNOS 3.0.2 GA
- Initial WiFi 7 Support
- WiFi 6E Enhancements
- Dynamic VLAN enhancements

APNOS 3.1 GA
- WiFi 7
- Mediatek Kernel and Firmware alignment with Mediatek SDK
- Device Fingerprinting
- AFC

APNOS 3.2 GA
- PKI - Full Cert Lifecycle management
- WiFi 7 QSDK Updates
- MPSK Enhancement Mode
- Kernel Updates

APNOS 4.0 GA
- Indoor AFC Location Support
- TBD

Hardware Platforms

CIG/Actiontec: WF-189
Sercomm: AP72TIP
EdgeCore: EAP111, EAP102, OAP102
Wallys: DR6018-V4
Cybertan: EW631

Wi-Fi 7 Ceiling PoE

Wi-Fi 7 Desktop

Wi-Fi 7 Industrial

Wi-Fi 7 Outdoor

Test & Quality

Release Engineering
- Test Automation
- How To videos and documentation

Tech Pubs
- Enhanced Tech Pubs
- Use case How Tos

√ Text = *Completed*

* Text = *Pending*

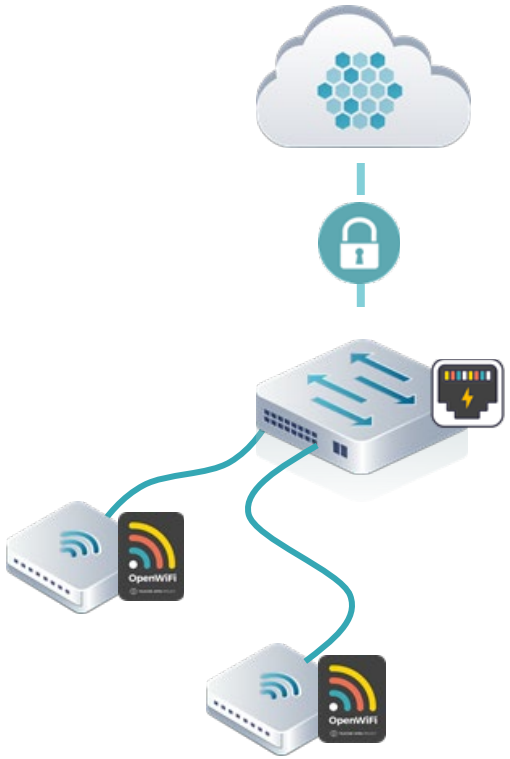
Text = *Community Contrib.*

All Good | At Risk/TBD | Blockers | Mitigation in place

OpenLAN Switching (OLS)

Behind every great OpenWiFi AP… You need a great PoE switch

OpenLAN Switching (OLS)



OpenLAN Switching Goals:

- Enable diverse, open & competitive alternatives for campus switching
- Replicate OpenWiFi attributes
  - Diverse Whitebox lineup (8-48 ports)
  - Open interfaces & open-source SW
  - Validated solution, hardened system
  - Zero touch deployment, secure by design
  - Unified cloud management for Wi-Fi & switching
- Solve for next major network upgrade
  - High power (PoE++), high throughput & low latency (WiFi 6E/7 ready)
  - Cloud managed, advanced L2 & L3 feature set

BROADCOM

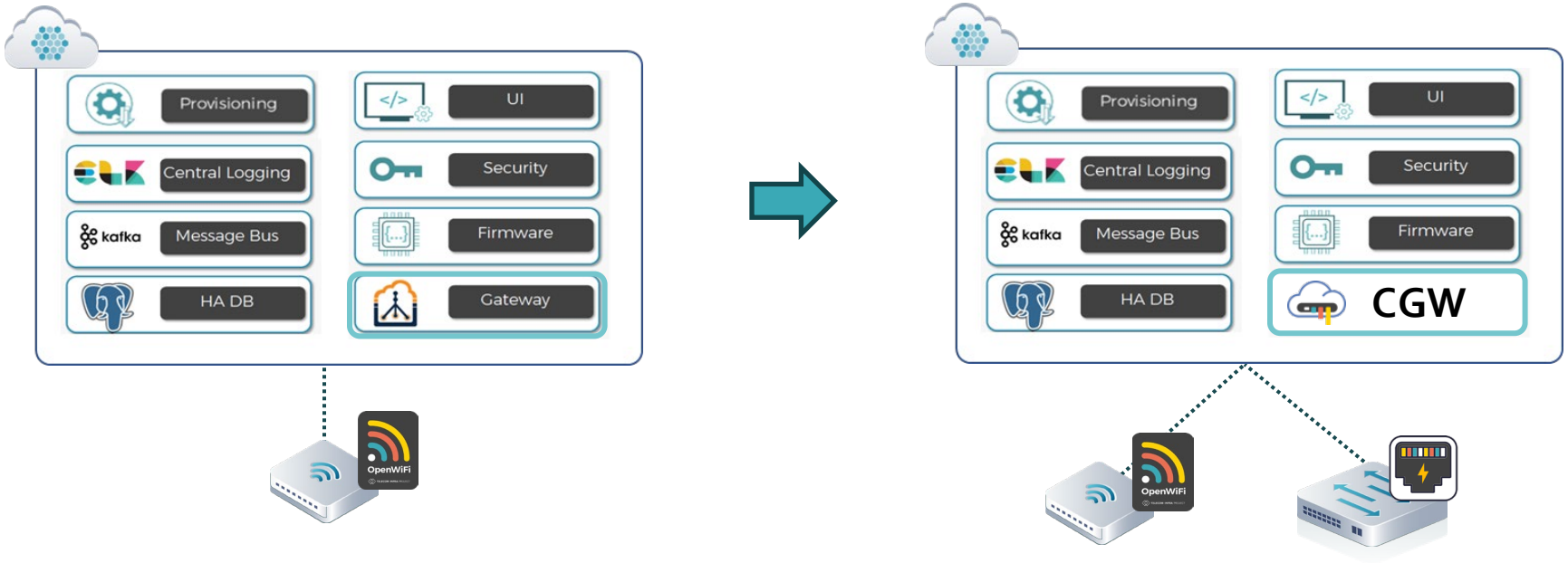
SHASTA CLOUD

Edge-corE NETWORKS

Architecture Evolution

New microservice called CGW (Cloud Gateway)

- Addresses roadmap requirements (Scale, OLS, Topology)
- Decoupled microservice (can be deployed without the rest of the CloudSDK)
- Designed and developed by the community



OpenLAN Business Group: Update

What is it?

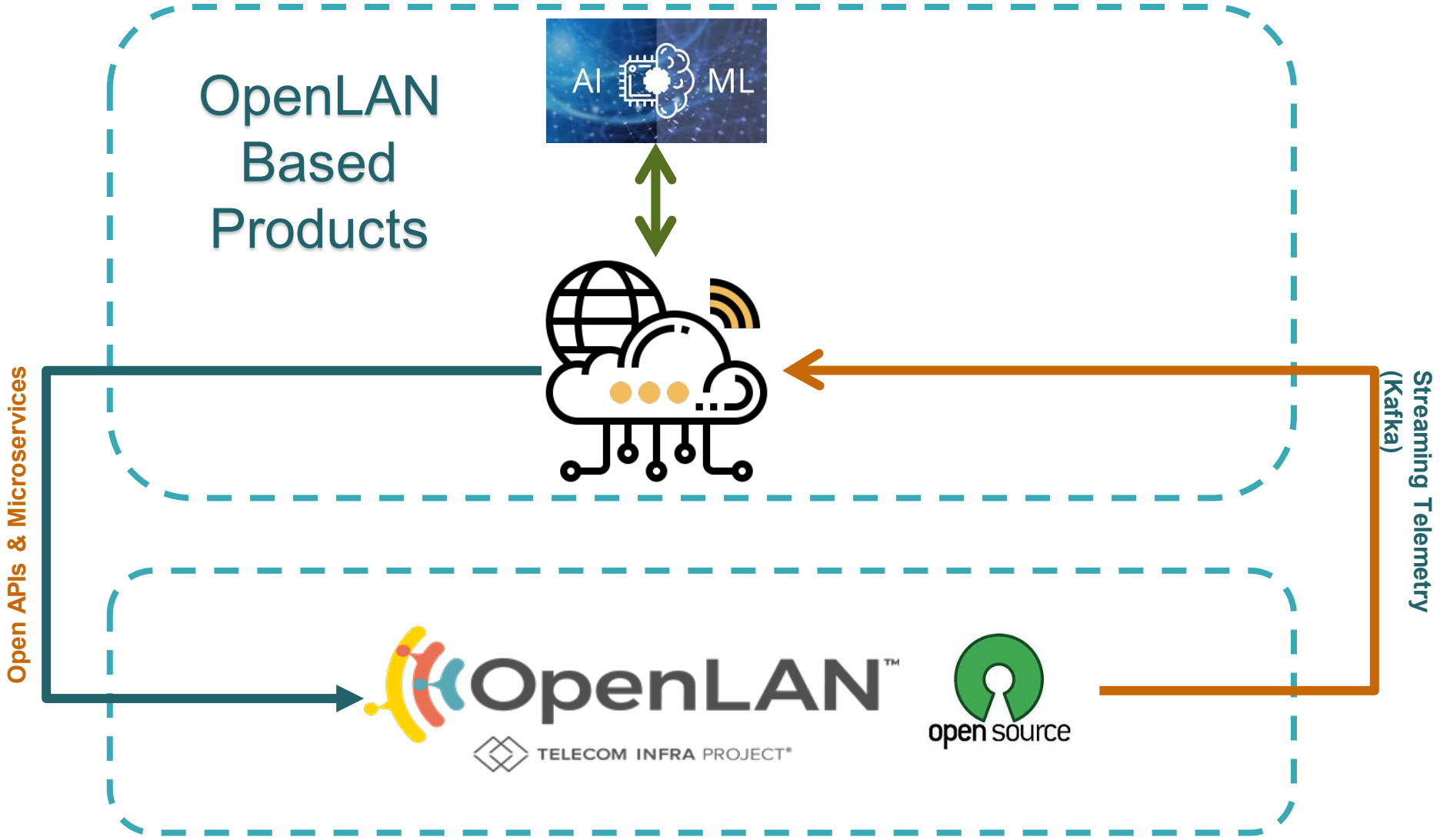
- Started life as "MSP Alliance"
  - Mid-to-large Wi-Fi Managed Service Providers actively trialing OpenLAN, or doing actual commercial deployments
  - Migrating to OpenLAN Business Group in the coming weeks

Limited Membership

- For 2024, membership consists of MSPs that typically deploy 10,000 APs or more per calendar year
- Purpose is to aggregate requirements across MSPs to help drive roadmap in a way to enable large-scale OpenLAN deployments
  - Members share learnings and best practices with each other and on PG calls
- Ecosystem vendors occasionally invited as guests to calls to present roadmaps and to drive specific discussions
- Current members include Ask4, Boingo, Pavlov Media, MultiNet, Single Digits, Spectra, Telus, WiFirst, Wirestar, WorldVue
- Additional members meeting 10K AP requirement are welcome to join

TIP OpenLAN

AL/ML Enabler



OpenLAN Summit

1. Jack Raynor - Meta
   Welcome Address
2. Robert Grosz – WorldVue
   OpenWiFi Case Study
3. Tim Race – Shasta Cloud
   Shasta Cloud & OLS
4. Huw Rees – NetExperience
   NetExperience Solution Overview
5. Dr. Derek Peterson, Eran Dor, Kevin Franzen
   MSP Alliance Roundtable

Thank You!

Wireless Global Congress Americas

Bart Giordano

President – Networking, RUCKUS Networks.

Wi-Fi 7+AI – The Real Reason You WANT IT! NOW!

RUCKUS®
COMMSCOPE

Wi-Fi 7 + AI:

The REAL reason you WANT IT! NOW!

Bart Giordano

President, Networking, Intelligent Cellular, and Security
CommScope

Date: June 2024

We are **NOT** going to talk about mundane stuff

Peak data rates, aggregate throughput
Under ideal conditions

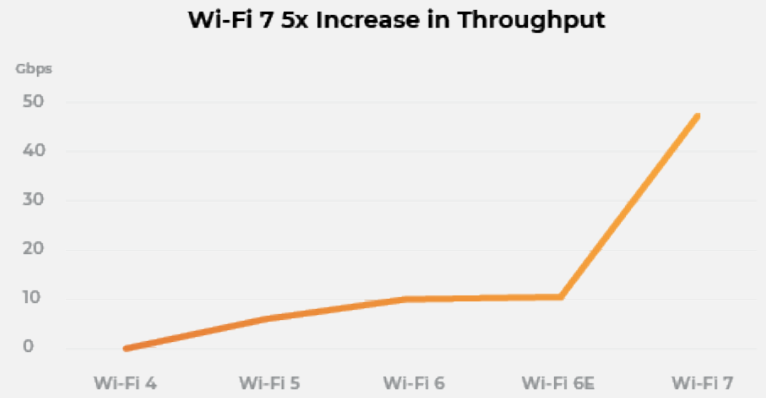
Network efficiency and capacity
Under real-world conditions
Improve average & worst-case performance

 |

Wi-Fi 7 : Multifold improvement in throughput, latency and capacity

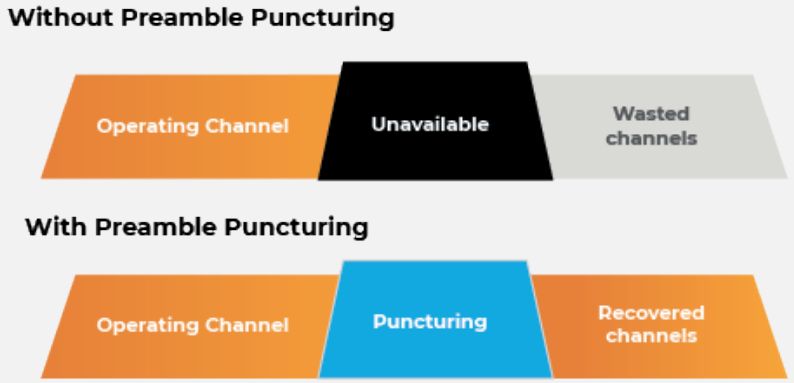
Extremely High Throughput

- 4K QAM
- 16 spatial streams
- 320 MHz wide channels



Punctured Transmission

- Increased channel availability
- Better throughput
- Lower latency



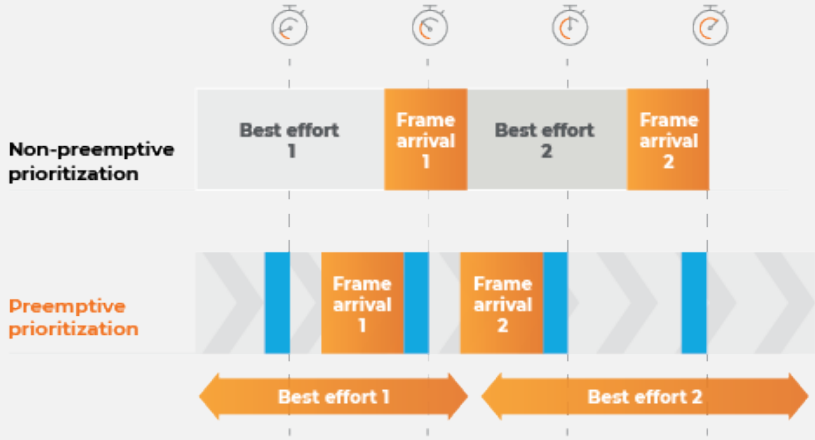
Multi-Link Operation

- Link redundancy (resilience)
- Link aggregation (throughput)
- Link selection (latency)

MLO (Multi-Link Operation)

Enhanced Quality of Service

- Deterministic Low Latency

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COMMSCOPE
Wi-Fi 7 + AI In the Wild

New use cases and requirements

Low latency, affected by:

- Distance
- Speed
- Media Contention

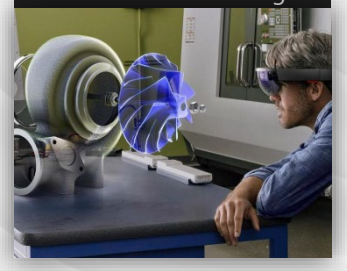
High Reliability

High speed

- Extended reality (AR/VR)
- Post pandemic Video Conferencing explosion

Remote Research

Collaborative 3D design



- Social Gaming & e-Sports
- 8K Streaming

Arena gaming

- IoT/Operational Technology

Operational Technology - IoT

Operational Technology - Manufacturing

Wi-Fi 7 Adoption in Key Verticals: What we are hearing

Verticals where **QoE over Wi-Fi** is strategic and critical to business and/or customer satisfaction

Manufacturing Warehousing Logistics	Hospitality	Education	Large Public Venues

 |

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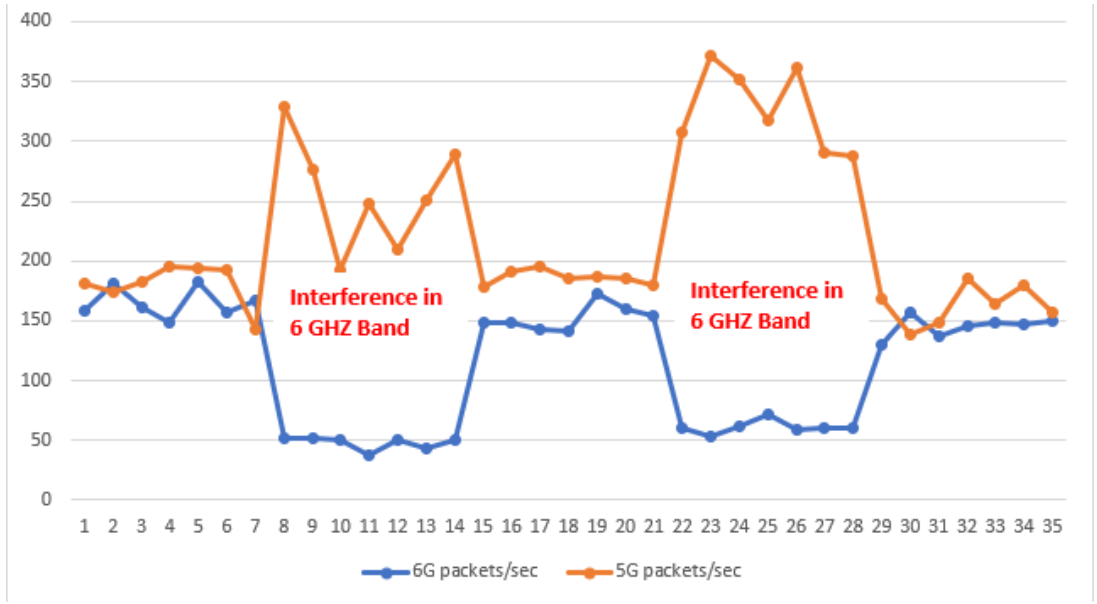
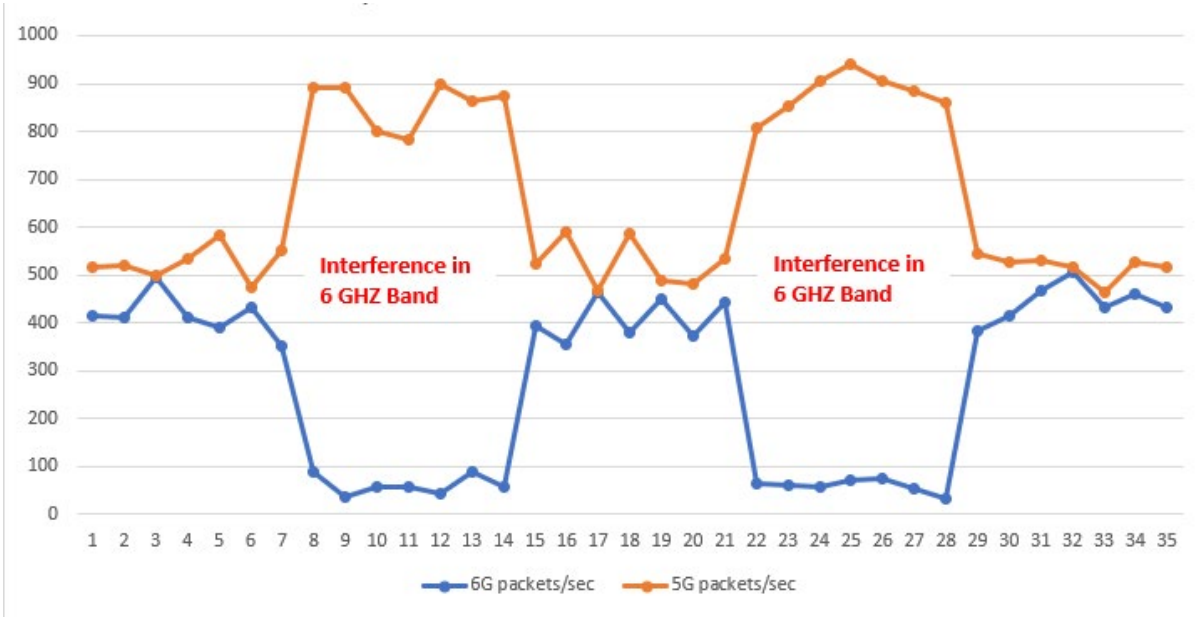
Let’s Talk About

The Real
Wi-Fi 7

Multi-link Operations(MLO) | What Interference?





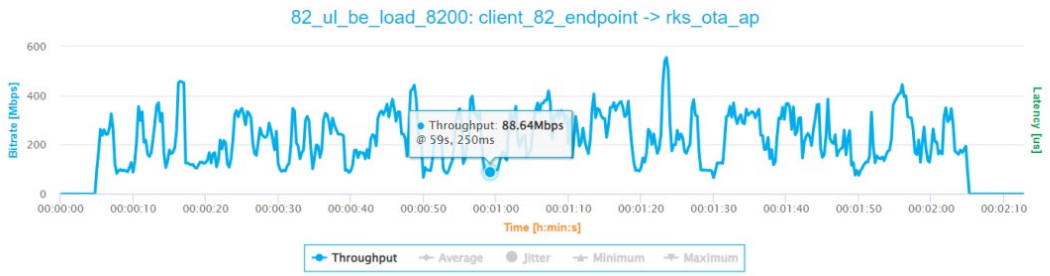
UPLINK

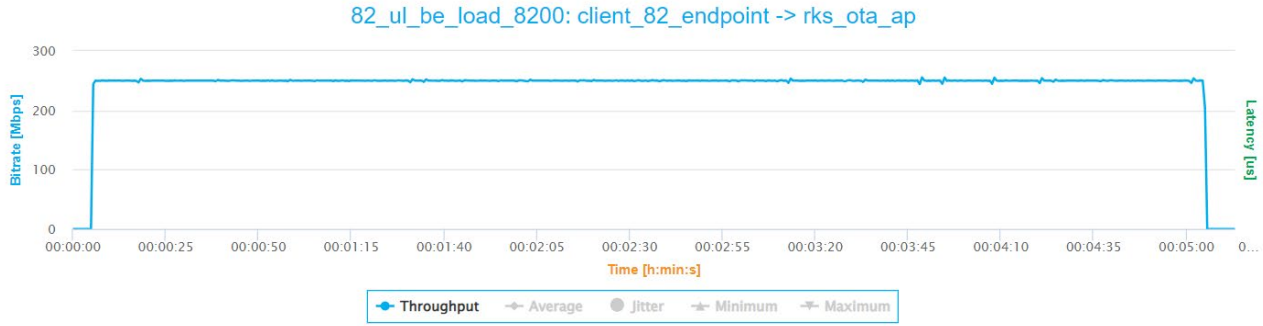
DOWNLINK

With MLO

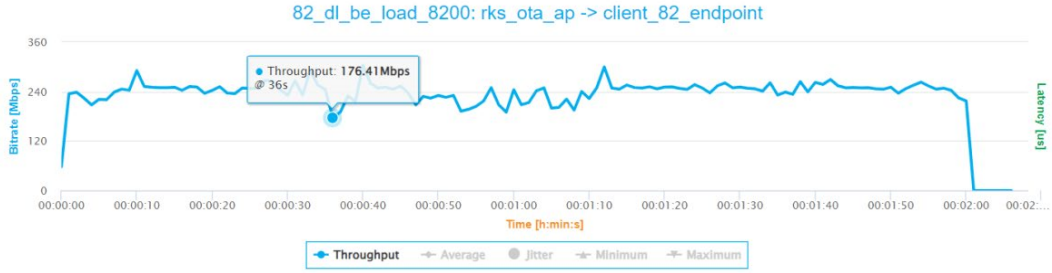
Yes, We Tested in RUCKUS Labs

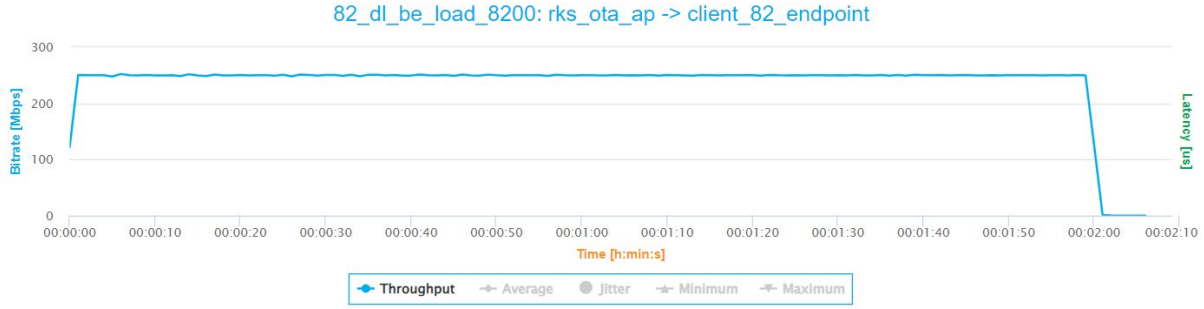
Multi-link Operations(MLO) | What Throughput Loss?





~40% Gain With MLO





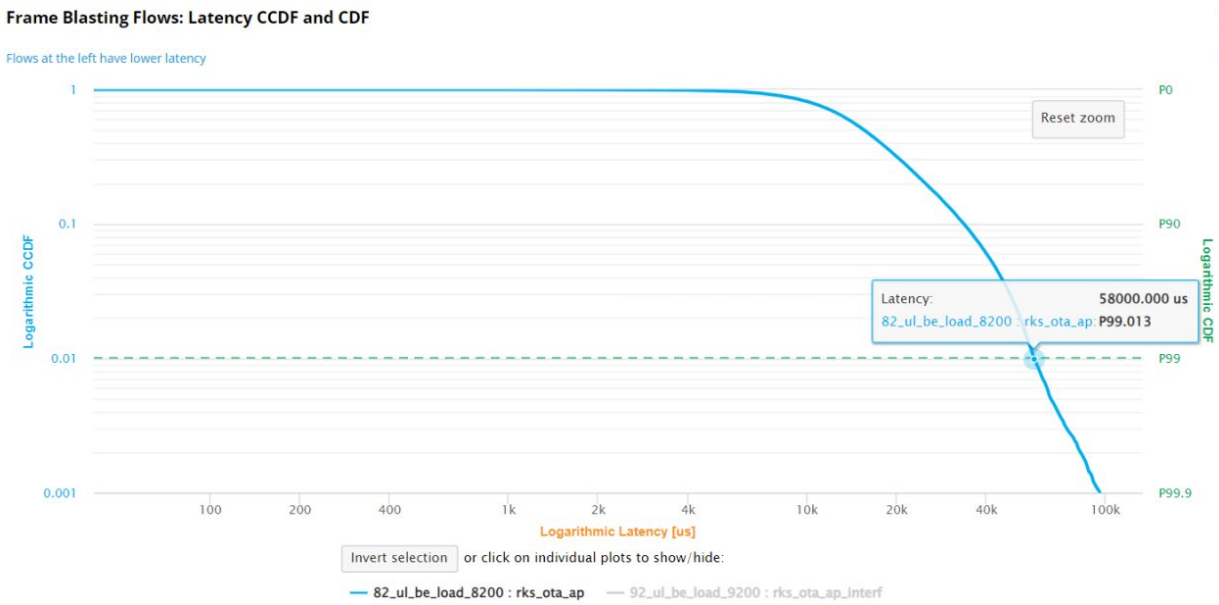
Without MLO

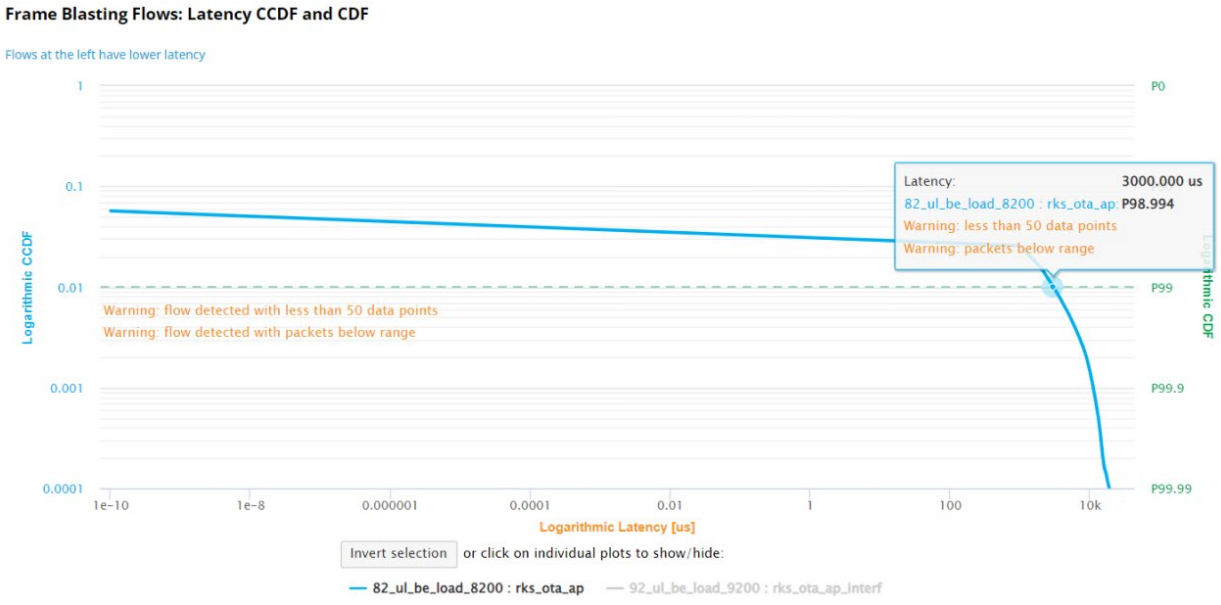
With MLO

Yes, We Tested in RUCKUS Labs

Multi-link Operations(MLO) | Latency? What Latency?

19X improvement at the 99th %tile



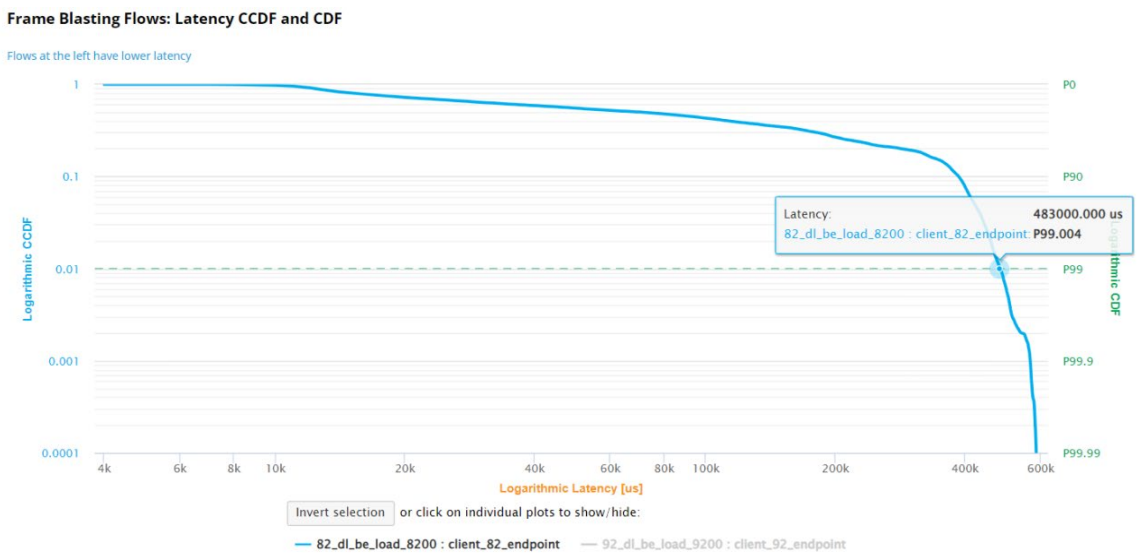


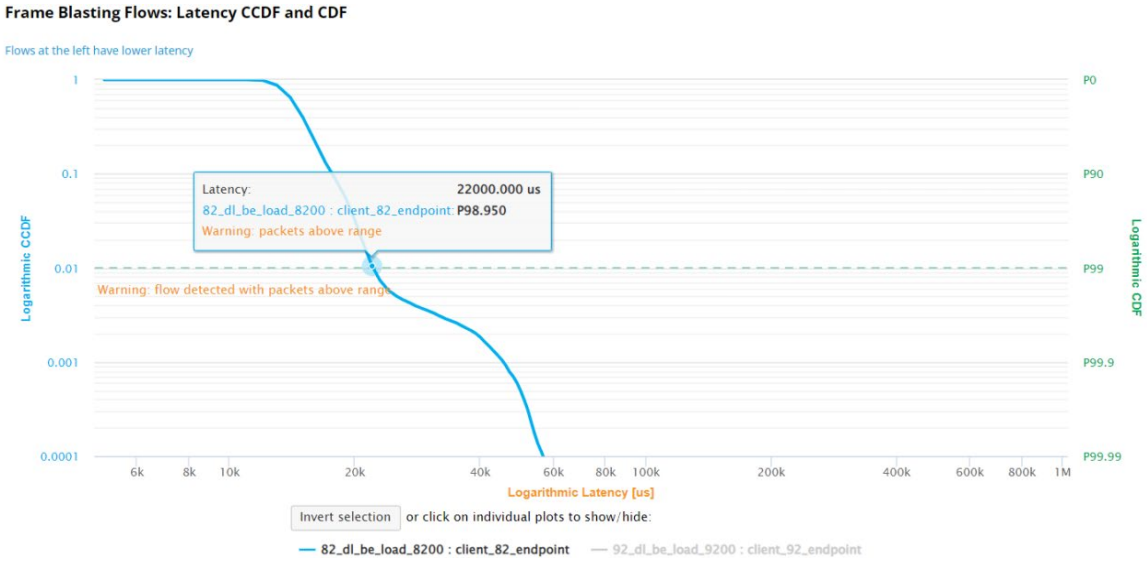
Without MLO | **Uplink** | **With MLO**

Yes, We Tested in RUCKUS Labs

Multi-link Operations(MLO) | Latency? What Latency?

22X improvement at the 99th %tile





Without MLO | Downlink | With MLO

Yes, We Tested in RUCKUS Labs


RUCKUS
COMMSCOPE
AI TAKES Wi-Fi 7
EXPERIENCE TO A WHOLE NEW LEVEL

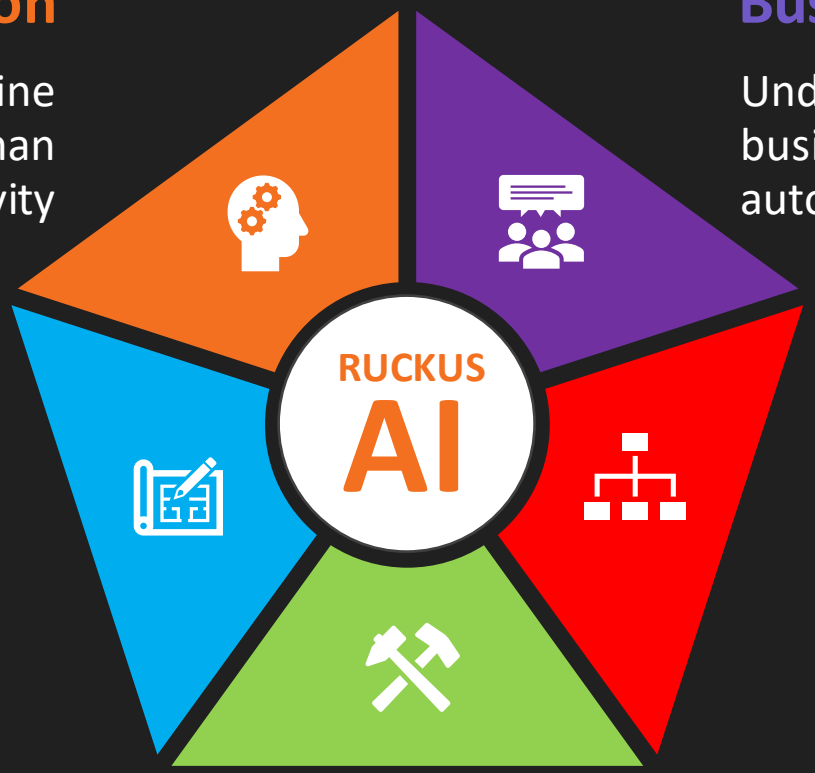
Role of AI within enterprise networks is exploding

Intelligent Orchestration

Orchestration and automation of routine and repetitive tasks to minimize human errors and improve productivity

Business Intent Cognition

Understands the business intent and translate business requirements and policies into automated network configurations



Design and Optimization

With the increasing complexity in wireless technologies, AI-Driven network optimization is essential to network performance

Dynamic Network Management

Dynamic network configurations to tune networks based on network usage, traffic patterns and RF environment

Network Troubleshooting

Auto identification, root cause analysis and recommended remediation actions

Gen AI-based agents will accelerate innovation in this space

RUCKUS AI Takes Wi-Fi 7

Network Efficiency To a Whole New Level

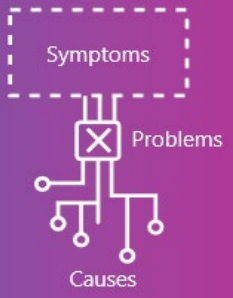
Surface issues before they blow up

ML-driven incident and anomaly detection

Address the most urgent issues first

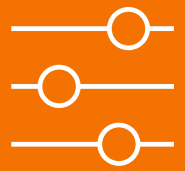
AI-driven prioritization

Fix them fast



ML-driven root cause and recommendations

Compare network KPIs before and after a change to analyze the impact

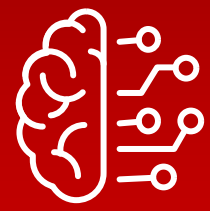


Config change analysis

Let the system make recommendations on changes to improve network performance

AI-recommendations

Let Cloud RRM drive down interference and maximize capacity every day.



AI-Driven Cloud RRM

Manufacturing Customers choose RUCKUS Networks for:

- Robust Wireless Performance
- Reliable Network Uptime
- Reduced Operation Costs
- Enhancing Automation

Simplicity | Reliability | Performance

Connectivity

Communication

Automation

Boise Cascade

McLANE

ceva LOGISTICS

RUCKUS Networks Delivered:

- Vast improvement in production line scanning
- Greater device data rates into MES and ERP systems
- Optimized processes by connecting more devices
- Increased coverage areas
- Less Equipment & Time Needed

Simplicity | Reliability | Performance

RUCKUS®
COMMSCOPE

What Happens When You Deliver Such An

INDUSTRIAL GRADE
Wi-Fi 7 Solution

Innovation of the Year Award 2024

RUCKUS AI-Driven Wi-Fi 7 Solution

RUCKUS® COMMSCOPE

- Recognized for
  - Breakthrough innovation
  - Addressing market challenges
  - Integration with other industry products
  - Value to the community
  - Ease of use and manageability
  - Functionality

The Wi-Fi AWARDS

Innovation of the Year

Source: https://thewifiawards.com/2024-award-finalists

THE ONLY ENTERPRISE VENDOR ON THE TEST BED OF Wi-Fi Certified 7

"We are happy to have a RUCKUS Networks Wi-Fi 7 commercial AP platform as part of our testbed for the Wi-Fi CERTIFIED 7 program. We look forward to the rapid adoption of Wi-Fi CERTIFIED 7 across home, enterprise and industrial environments, and take pride in facilitating interoperability among the entire Wi-Fi 7 worldwide device ecosystem. Wi-Fi CERTIFIED devices, such as those from RUCKUS Networks—a longtime member of Wi-Fi Alliance—help deliver a good user experience in the enterprise,"

Kevin Robinson

President and CEO, Wi-Fi Alliance

RUCKUS Wi-Fi 7 AP

RECEIVES AFC DEVICE CERTIFICATION FROM THE FCC

PURPOSE-DRIVEN
ENTERPRISE NETWORKS

Wireless Global Congress Americas

Kevin Robinson

President & CEO, Wi-Fi Alliance.

Wi-Fi®: driving next-generation innovation and impact for 25 years

Wi-Fi®: driving next-generation innovation and impact for 25 years

Wireless Global Congress Americas
Kevin Robinson, Wi-Fi Alliance®
June 2024


25
YEARS
Wi Fi
ALLIANCE

Celebrating 25 years of transforming connectivity

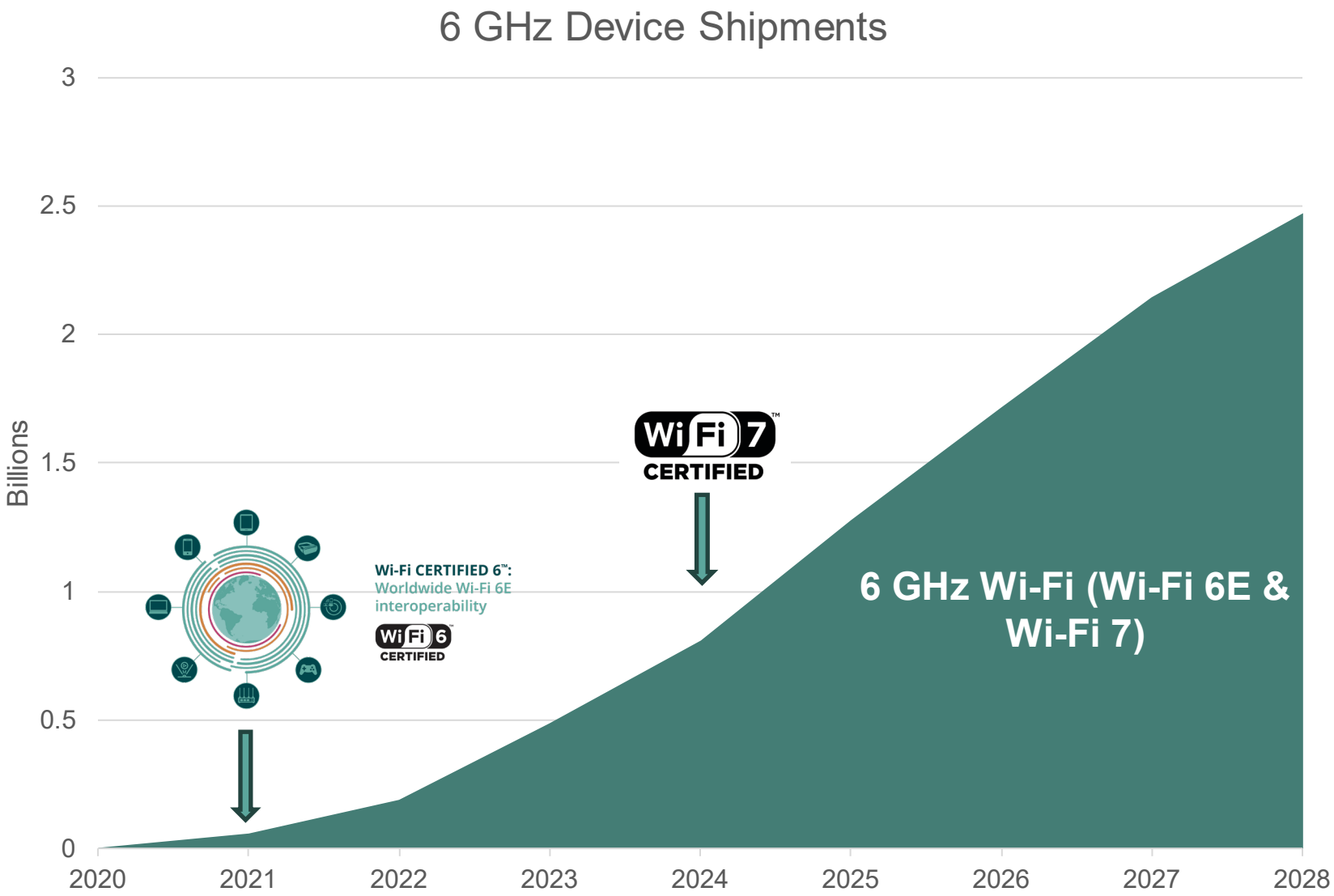
Over the past quarter-century, Wi-Fi has made advancements in performance, range, reliability, and security

With more than 21 billion devices in use today, Wi-Fi has transformed the way we work, live, and play

Wi-Fi Alliance® is committed to delivering solutions and features that enrich global Wi-Fi user experiences

Join us as we celebrate this connectivity milestone throughout 2024!

6 GHz: The foundation for next generation Wi-Fi



IDC Research , 2023

6 GHz Wi-Fi as Foundation for Esports

- In first-ever event, participants connected wirelessly to the Apex Legends event using the Nokia Beacon 10 Wi-Fi 6E router in May 2024
- Showcased Wi-Fi's "near-deterministic latency and ethernet-like performance" in esports scenarios
- 6 GHz Wi-Fi allows ISPs to deliver the desired experience without the need for specialized gaming routers

"Running an Esports event like this targeting specifically pro-players playing over Wi-Fi was long thought to be impossible. Today, we're showing it can be done."

– Gino Dion, Head of Innovation Solutions at Nokia

6 GHz Wi-Fi as Foundation for Healthcare

- Wi-Fi Alliance is working with Ramathibodi Hospital to test 6 GHz operation for medical education
- Demonstrating capabilities and benefits of 6 GHz Wi-Fi for healthcare applications
- This months-long trial will test the use of VR technologies in the medical environment
- Testing utilization of high-bandwidth technologies in dense environments with multiple users

A robust Wi-Fi CERTIFIED 7™ device market emerges

Huawei AirEngine 5776-26 Access Point

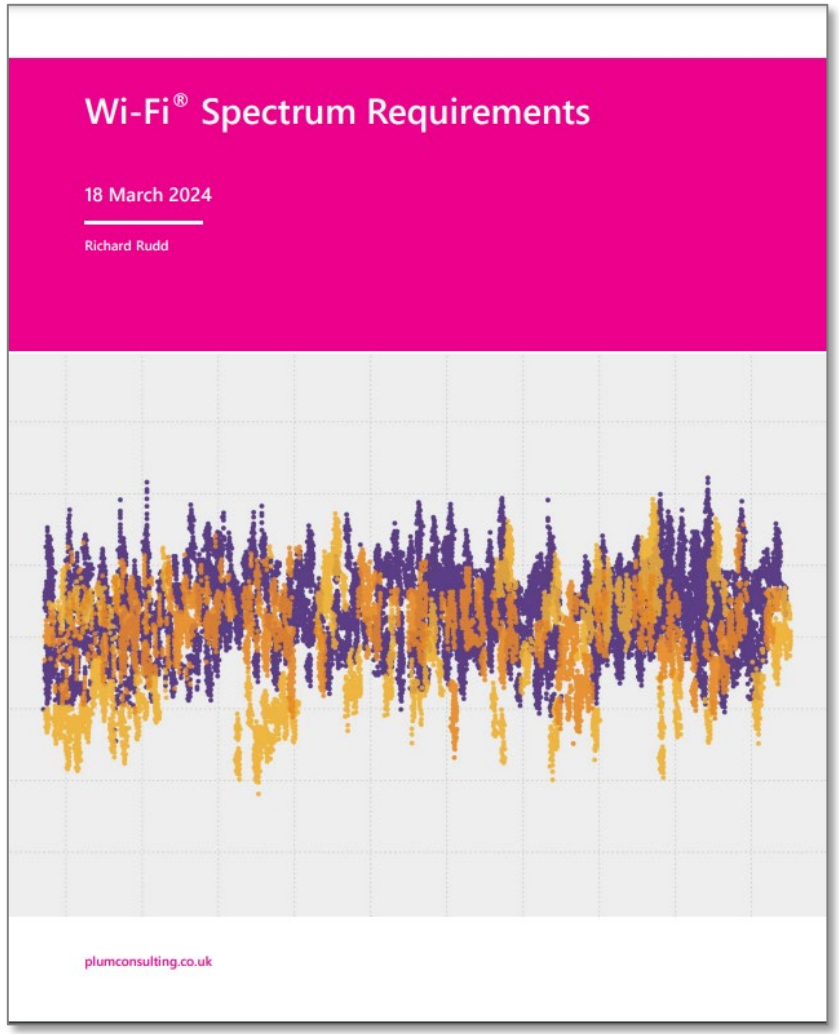
Google Pixel 8

Samsung Galaxy S24 Ultra

TP-Link Deco BE85 Tri-Band Whole Home Mesh Wi-Fi 7 System

Nokia WiFi Beacon 24 quad-band gateway

New industry resource underscores 6 GHz spectrum is necessary to achieve gigabit infrastructure goals

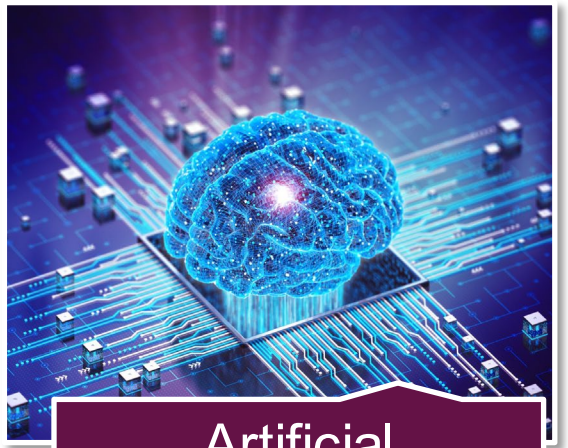


Wi-Fi Spectrum Requirements study confirms that limited Wi-Fi spectrum availability in Europe degrades performance and undermines gigabit infrastructure investments

Standard power delivers even more from 6 GHz

- Standard power 6 GHz with Automated Frequency Coordination (AFC) opens new use cases for AR/VR/XR, IIoT, and outdoor Wi-Fi
- Wi-Fi Alliance is leading the development of specifications, test plans, and training modules to enable implementation of 6 GHz standard power devices under control of the AFC system
- Feb 2024: FCC approved commercial operators of 6 GHz AFC systems
- Apr 2024: Wi-Fi Alliance enhanced its AFC Device (DUT) Compliance Test Plan and AFC DUT Test Harness Tool for 6 GHz standard power devices to comply with Canadian standards

The next generation of applications emerge as a result of today's advanced Wi-Fi capabilities



Artificial Intelligence

Industrial IoT

Extended Reality

Space Station

Near-term areas for continued Wi-Fi innovation

Advocating for global adoption of 6 GHz Wi-Fi including expansion of regulatory framework for standard power using AFC

Improving Wi-Fi device interaction and performance in real-world scenarios through hosted interoperability events and residential deployment sandbox

Engaging with Wi-Fi customer segments to ensure Wi-Fi remains a catalyst for innovative market solutions

Thank you

Cheers to 25 years of Wi-Fi!

Wireless Global Congress Americas

Panel: New Business Opportunities in the Wi-Fi 7 Era

Eric McLaughlin

VP & GM Wireless Solutions Group, Client Computing Group, Intel Corporation.

Kevin Robinson

President & CEO, Wi-Fi Alliance.

Robert Stacey

Chair – 802.11 WorkGroup, IEEE.

Wireless Global Congress Americas

WGC AMERICAS

CONNECTING OUR DIGITAL WORLD

LUNCH BREAK & NETWORKING
BE BACK IN 55 MINUTES AT 1.55 PM CT

Wireless
Global Congress
Americas

Steve Namaseevayum

Vice President, Membership & Industry Alliance.
Wireless Broadband Alliance.

Session Moderator

Wireless Global Congress Americas

Time	Presentation
1:55 PM (CT)	**Moderator Introduction** Steve Namaseevayum, Vice President Membership & Industry Alliances, Wireless Broadband Alliance.
2:00 PM (CT)	**The Future of WI-Fi CX** Jenni Dettman, VP Marketing.
2:20 PM (CT	**Empowering Small and Medium Businesses: Leveraging Platforms and Managed Wi-Fi** Scott Stinson, Head of Customer Solutions; Airties; Ricky Taft, Senior Lead Product Manager, Broadband Devices, Con Communications; Sudeep Bose, Senior Director Product Management, Synamedia.
2:40 PM (CT)	**Providing Access to decentralized Connectivity** Carlos Lei, CEO, Uplink
2:50 PM (CT)	**Real Application Performance with Wi-Fi 7- Data Driven Insights** Prasanna Chamala, Director of Sales, Alethea Communications.
3:00 PM (CT)	**Panel: Enabling new Business Cases with Wi-Fi Halow** Panel Moderator: Jonah Ross, Manager, PMO, Wireless Broadband Alliance Paul Lai, CEO, AsiaRF; Zac Freeman, EVP, Sales & Marketing; VP, Product & Marketing, Newracom; Prakash Guda, Morse Micro.
3:20 PM (CT)	**Panel: Addressing new business opportunities for operators and service providers** Panel Moderator, George Hechtmann, Hechtmann Venture Development. Bernard Herscovici; President, NetExperience; Rajat Ghai, Vice President - Xfinity Wi-Fi Engineering, Comcast. Russ Keveryn, Senior VP of Sales, RouteThis.
3:50 PM (CT)	COFFEE & NETWORKING

Wireless Global Congress Americas

Jenni Dettman

VP Marketing, RouteThis.

The Future of Wi-Fi CX

RouteThis

WGC Americas 2024

The Future of Wi-Fi CX

June 2024

The Future of Wi-Fi Customer Experience (CX)

Jenni Dettman

VP, Marketing

RouteThis DZS Adtran EMERSON

RouteThis

About RouteThis

Founded **2017** to provide **Wi-Fi CX** solutions for Service Providers and Smart Home companies

190+ customers worldwide

Series A backed by **Intel Capital** and **Inovia Capital**

>$240M in realized value

RouteThis

Cloud platform

CPE-agnostic

Customer first

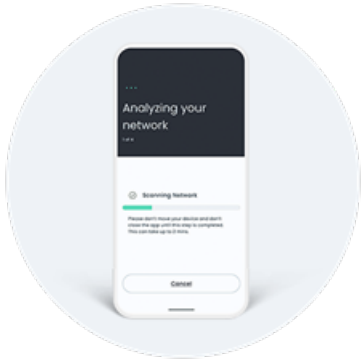
RouteThis Certify

Field support for technicians

Arm field techs with tools to optimize in-home Wi-Fi networks for the best Quality of Experience.

- Wi-Fi Installation
- Wi-Fi Repair

Wi-Fi Management



RouteThis Helps

Self-support for customers

Empower end-users to resolve Wi-Fi issues without having to call tech support.

- Wi-Fi Support

RouteThis Resolve

Remote support for agents

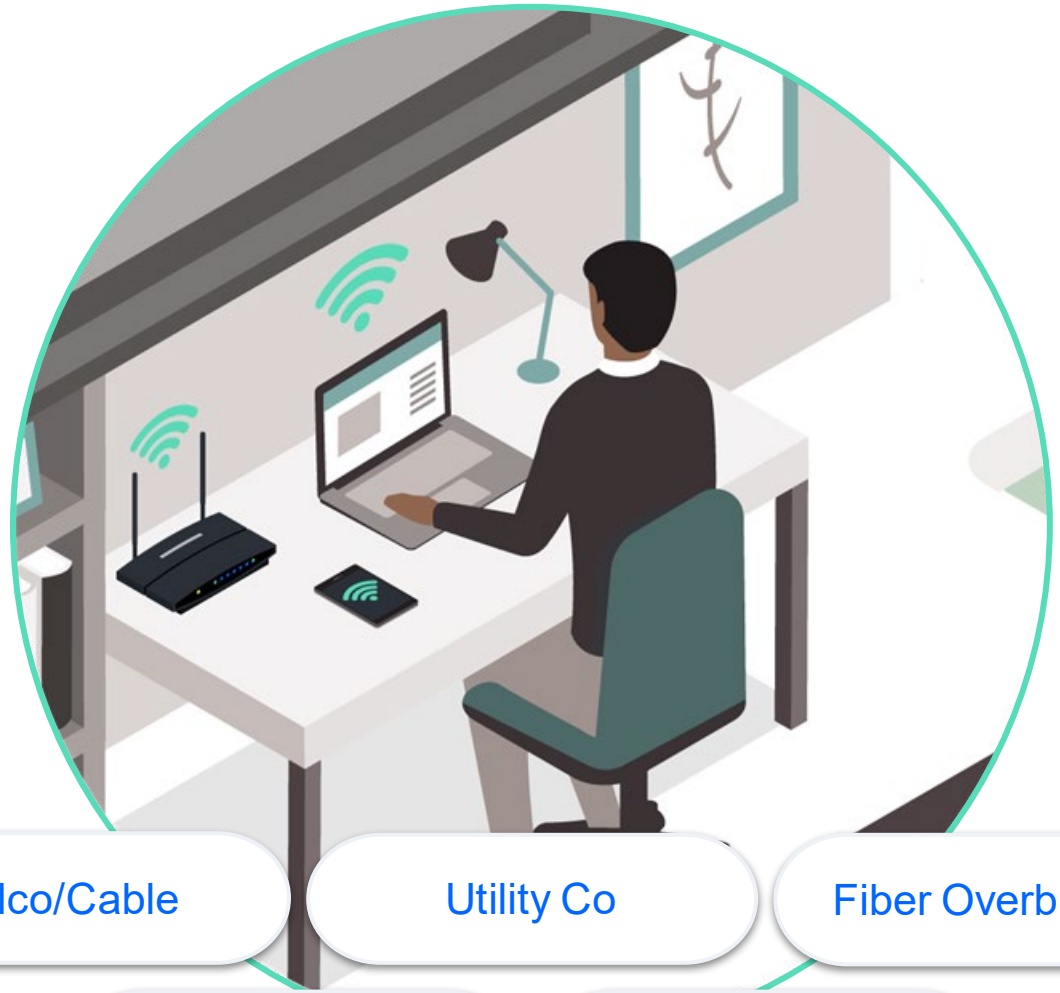
Provide support teams the ability to solve home Wi-Fi issues quickly and seamlessly.

- Wi-Fi Support

RouteThis

Subscribers have more options than ever before

The fastest speeds or lowest price is no longer enough to win - or keep - customers.



Telco/Cable

Utility Co

Fiber Overbuilder

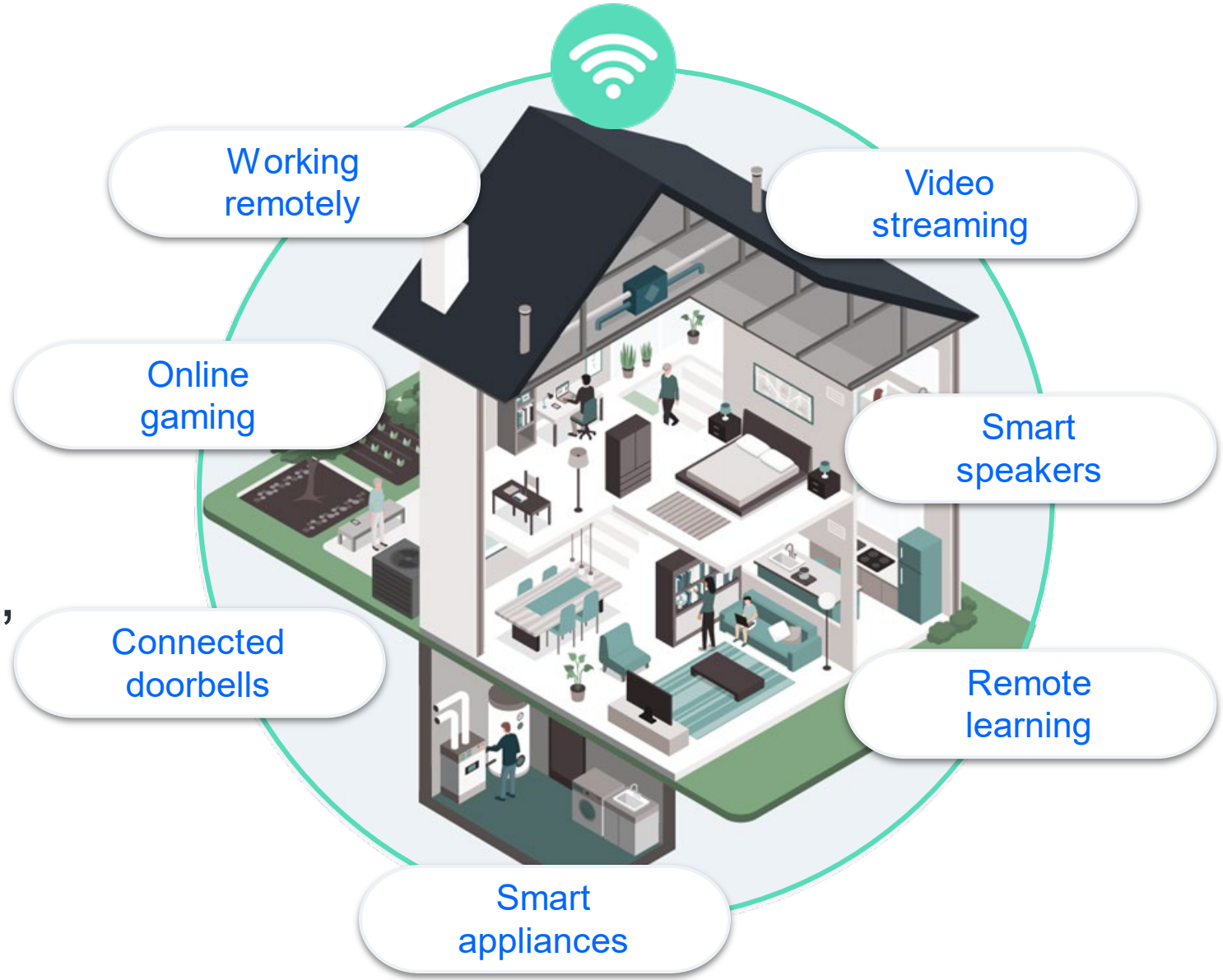
Mobile

Satellite

RouteThis

It’s all about the experience

Service Providers need to deliver flawless Wi-Fi connectivity to every device, in every room.



RouteThis

80% of customers say the experience a company provides is as important as its product or services.

52% of customers would switch to a company's competitor after one bad experience.

Companies that invest in improving customer experience have seen a **32%** increase in cross-selling and upselling.

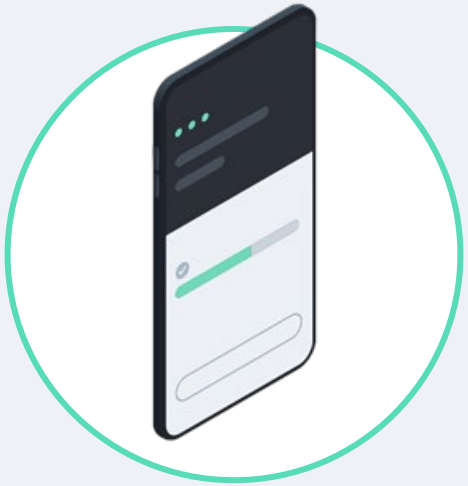
Sources: Salesforce, Keap, Zendesk

RouteThis

3 trends shaping the future of Wi-Fi CX

QoI

Quality of Experience (QoE) is driving the demand for high Quality of Installations (QoI)



DIY

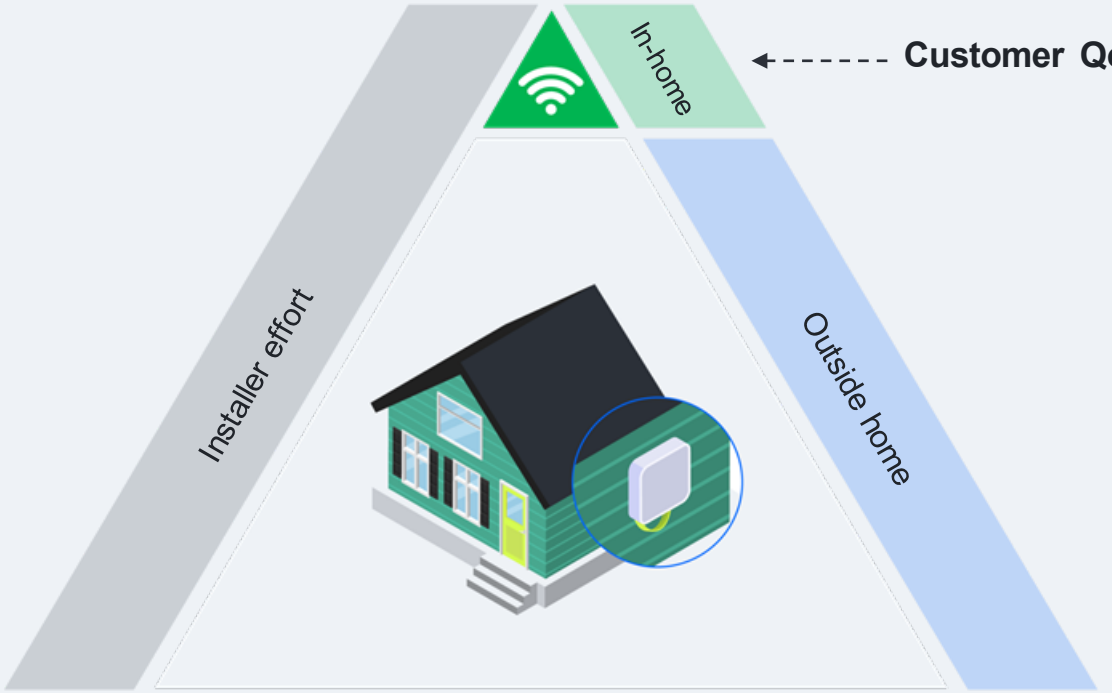
Customers want the ability to self install, manage, troubleshoot and support

AI

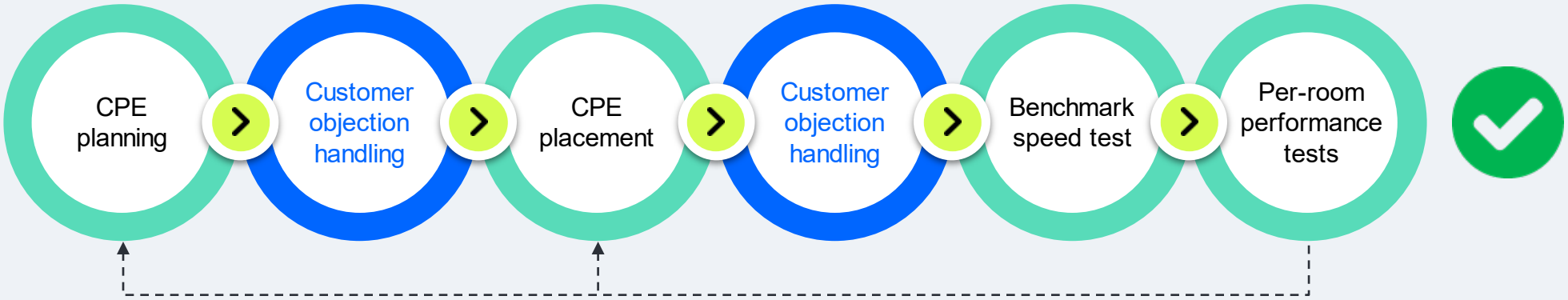
Automate everything from Wi-Fi configuration, agent efficiency and support calls

RouteThis

QoI

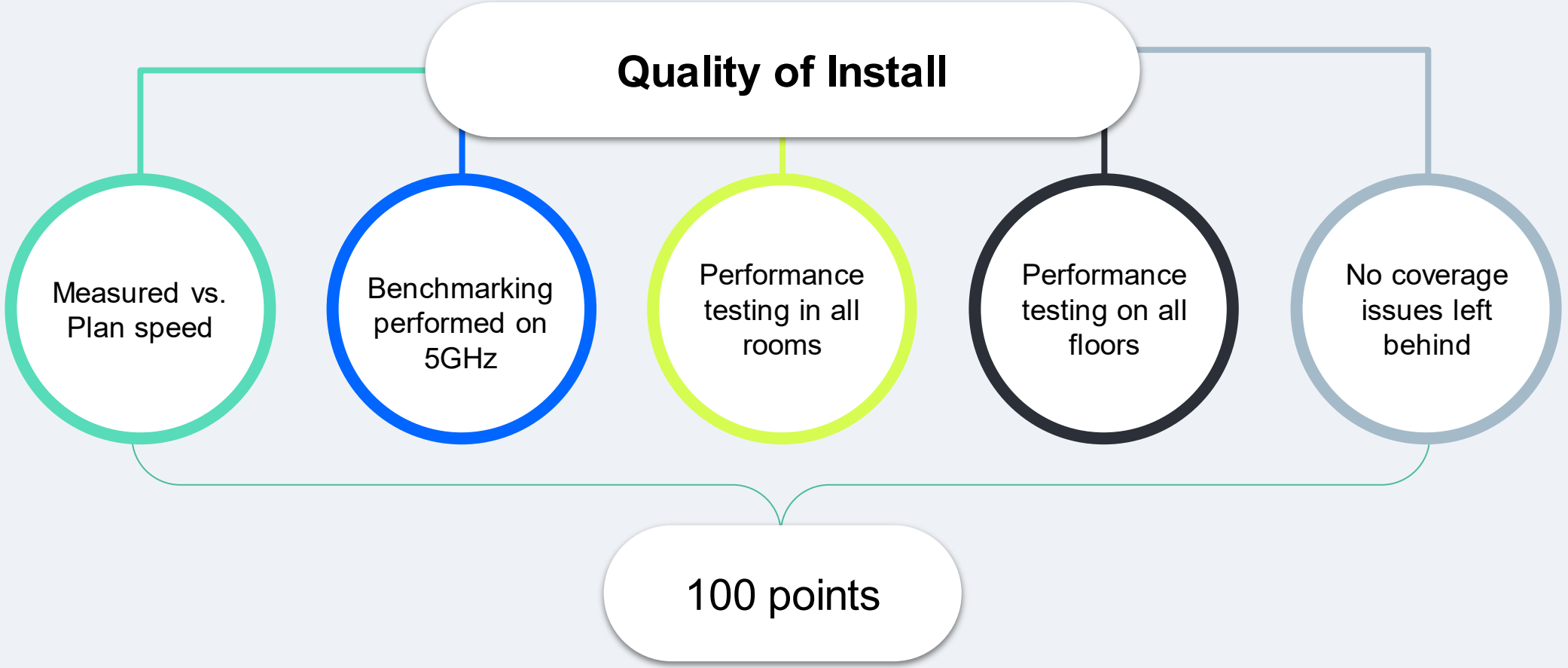


In-home installation workflow



RouteThis

5 key factors to measure QoI

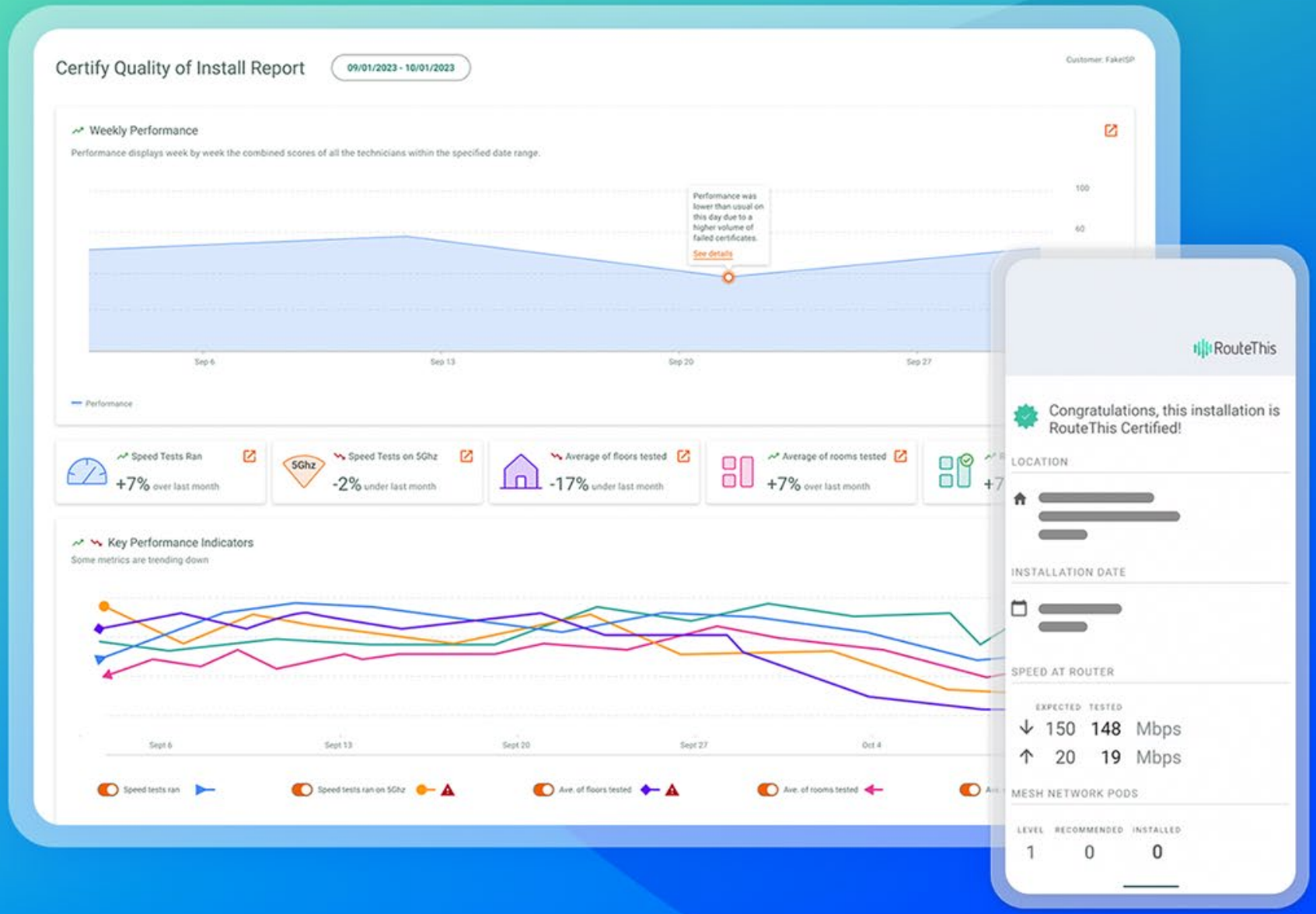


RouteThis

Certify tech visits for better Wi-Fi CX

- Optimize CPE placement
- Verify coverage and speed
- Educate customers
- Get it right from day 1
  (Good QoI → Good QoE = **Great CX**)

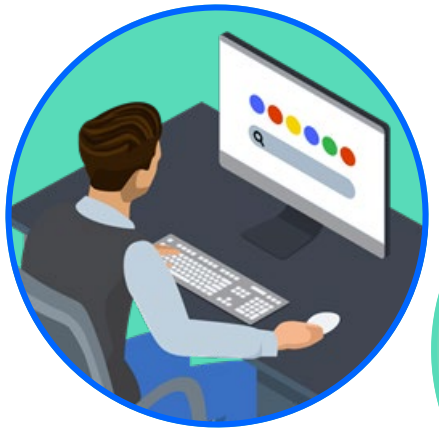
RouteThis


Certify Quality of Install Report
09/01/2023 - 10/01/2023
Customer: FakeISP
Weekly Performance
Performance displays week by week the combined scores of all the technicians within the specified date range.
Performance was lower than usual on this day due to a higher volume of failed certificates.
See details
100
60
Sep 6
Sep 13
Sep 20
Sep 27
Performance
Speed Tests Ran
+7% over last month
Speed Tests on 5Ghz
-2% under last month
Average of floors tested
-17% under last month
Average of rooms tested
+7% over last month
Key Performance Indicators
Some metrics are trending down
Sept 6
Sept 13
Sept 20
Sept 27
Oct 4
Speed tests ran
Speed tests ran on 5Ghz
Ave. of floors tested
Ave. of rooms tested
RouteThis
Congratulations, this installation is RouteThis Certified!
LOCATION
INSTALLATION DATE
SPEED AT ROUTER
EXPECTED TESTED
150 148 Mbps
20 19 Mbps
MESH NETWORK PODS
LEVEL RECOMMENDED INSTALLED
1 0 0

RouteThis

DIY

75% of customers believe that self-service is a convenient way to address customer service issues.



67% of customers prefer self-service over speaking to a company representative.

81% of customers attempt to solve issues themselves before calling into support.

Sources: Nuance Enterprise, Harvard Business Review, Zendesk

RouteThis

What does a great DIY experience look like?

Wi-Fi Installation

Wi-Fi Management

Wi-Fi Support

Easy to use

Personalized

Fast

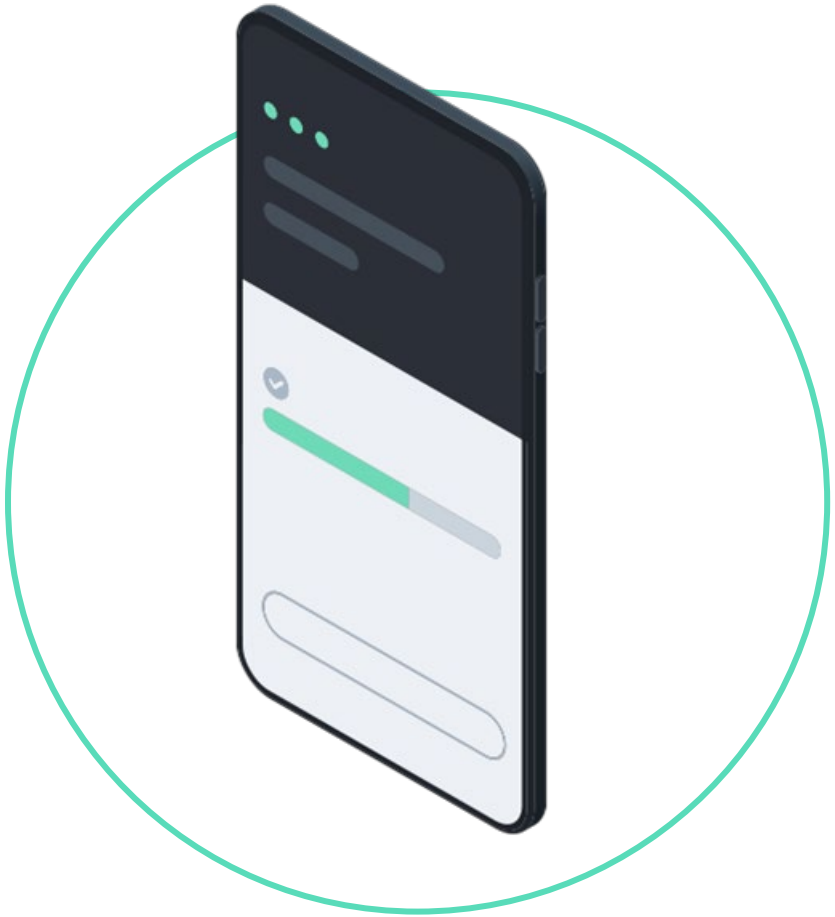
Accurate

Educational

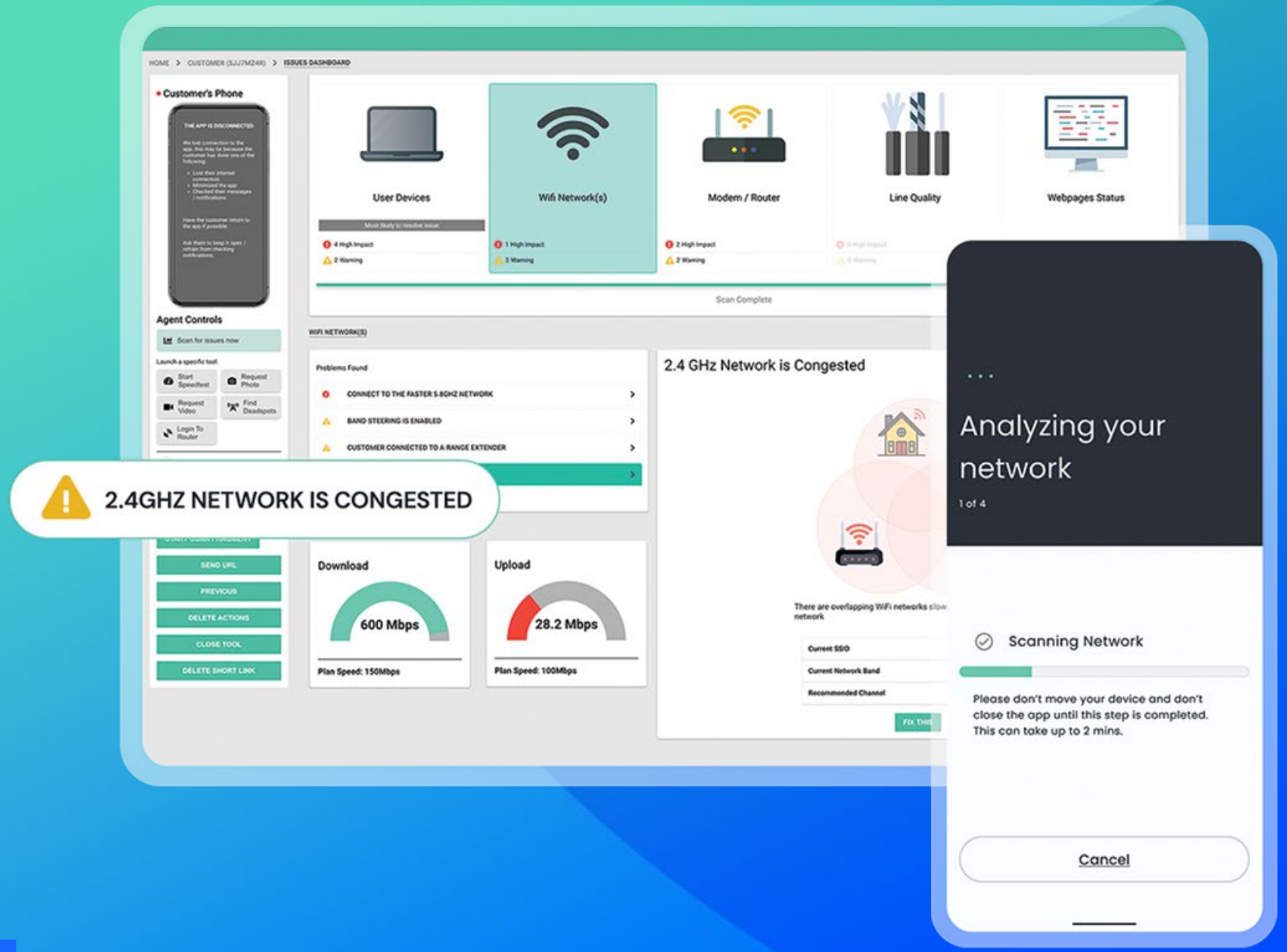
RouteThis

Empower customers for better Wi-Fi CX

- Offer self-service options
- Longer term - OpEx reduction
- More data = Upsell opportunities

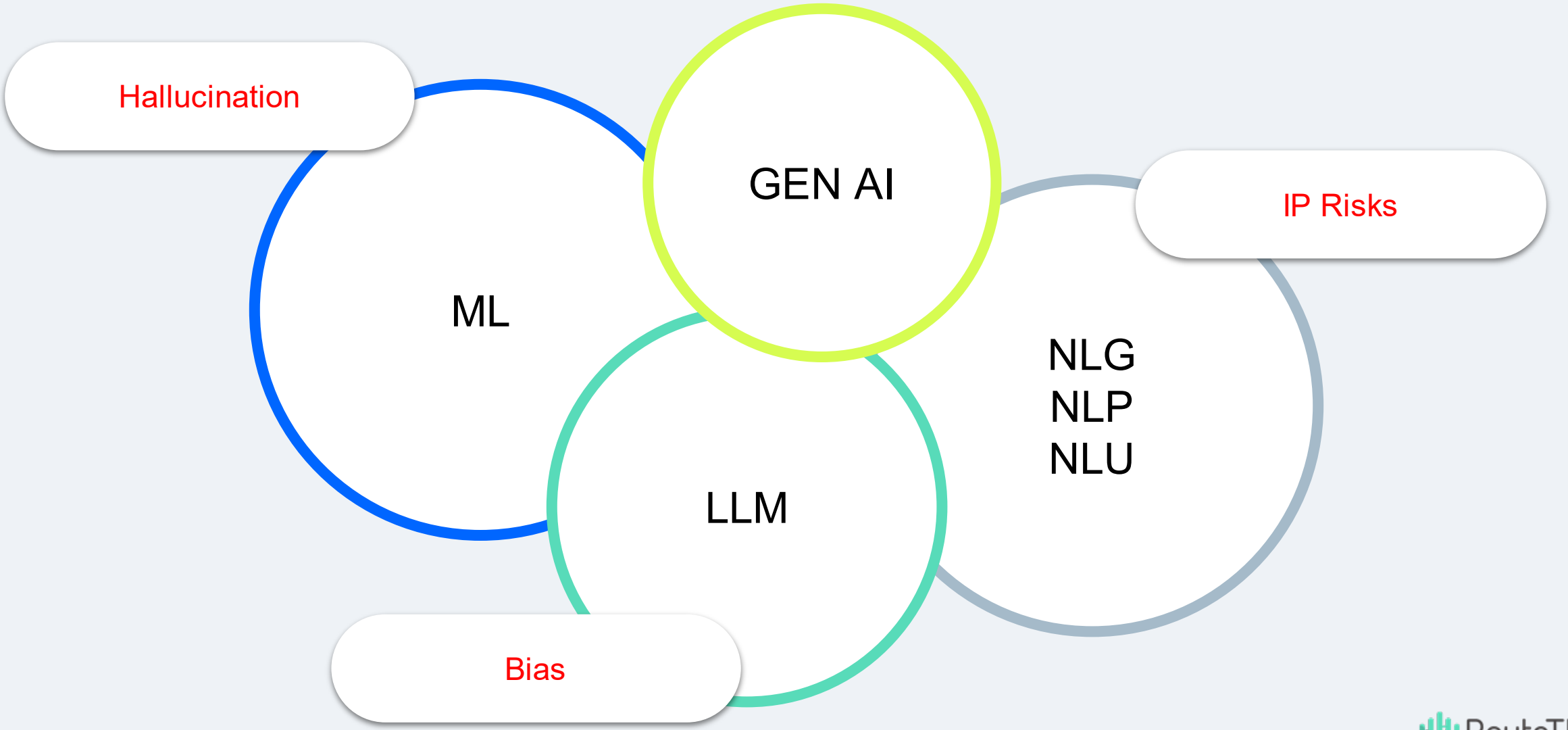


RouteThis


HOME > CUSTOMER (SJJ7MZ4R) > ISSUES DASHBOARD
Customer's Phone
THE APP IS DISCONNECTED
Agent Controls
Scan for issues now
Launch a specific tool:
Start Speedtest
Request Photo
Request Video
Find Deadspots
Login To Router
SEND URL
PREVIOUS
DELETE ACTIONS
CLOSE TOOL
DELETE SHORT LINK
User Devices
Wifi Network(s)
Modem / Router
Line Quality
Webpages Status
4 High Impact
2 Warning
1 High Impact
3 Warning
2 High Impact
2 Warning
Scan Complete
WIFI NETWORK(S)
Problems Found
CONNECT TO THE FASTER 5.8GHZ NETWORK
BAND STEERING IS ENABLED
CUSTOMER CONNECTED TO A RANGE EXTENDER
Download
600 Mbps
Plan Speed: 150Mbps
Upload
28.2 Mbps
Plan Speed: 100Mbps
2.4 GHz Network is Congested
There are overlapping WiFi networks slow network
Current SSID
Current Network Band
Recommended Channel
FIX THIS
2.4GHZ NETWORK IS CONGESTED
Analyzing your network
1 of 4
Scanning Network
Please don't move your device and don't close the app until this step is completed. This can take up to 2 mins.
Cancel

RouteThis

What does AI for Wi-Fi look like?

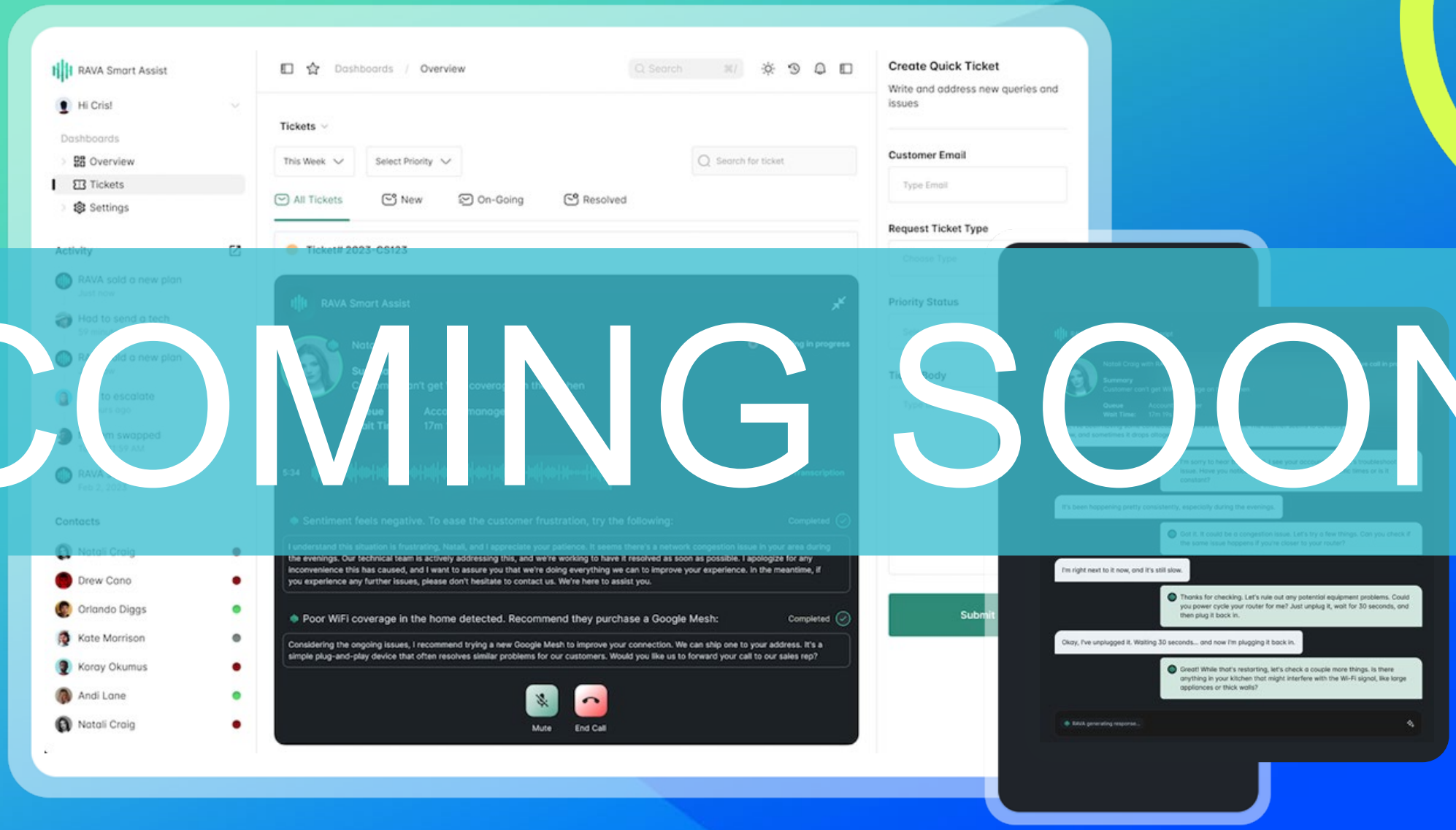


RouteThis

AI is Transforming Wi-Fi CX

- Hardware
- Software
- Support

RouteThis



COMING SOON

RouteThis

Why should great Wi-Fi CX matter to ISPs?

	Poor CX	Great CX
Customer retention	Frustrated customers who often churn	Loyal customers who promote your services
Upsell opportunities	Customers don't trust you	Customers are more likely to buy additional services
Call volume	Lots of unnecessary calls	Call volumes cut in half
Average handle time	Long, frustrating and inefficient calls	Fast troubleshooting and resolution

RouteThis

Thank You

Jenni Dettman
jenni@routethis.com

Connect on LinkedIn

Wireless Global Congress Americas

Panel: Empowering Small and Medium Businesses: Leveraging Platforms and Managed Wi-Fi

Scott Stinson

Head of Customer Solutions,
Airties.

Ricky Taft

Senior Lead Product Manager,
Broadband Devices,
Cox Communications.

Sudeep Bose

Senior Director Product Management,
Synamedia.

Wireless Global Congress Americas

Carlos Lei

CEO, Uplink.

PROVIDING ACCESS TO DECENTRALIZED CONNECTIVITY

Carlos Lei
CEO @uplink

PROVIDING ACCESS TO DECENTRALIZED CONNECTIVITY

uplink

WHAT IS DECENTRALIZED CONNECTIVITY?

Decentralized Connectivity refers to wireless infrastructure projects using financial incentivizes and tokenization to coordinate and incentivize their bootstrapping phase.

uplink

WHAT IS DECENTRALIZED CONNECTIVITY?

Individuals build up the supply of the infrastructure in a decentralized manner and get rewarded with financial incentives.

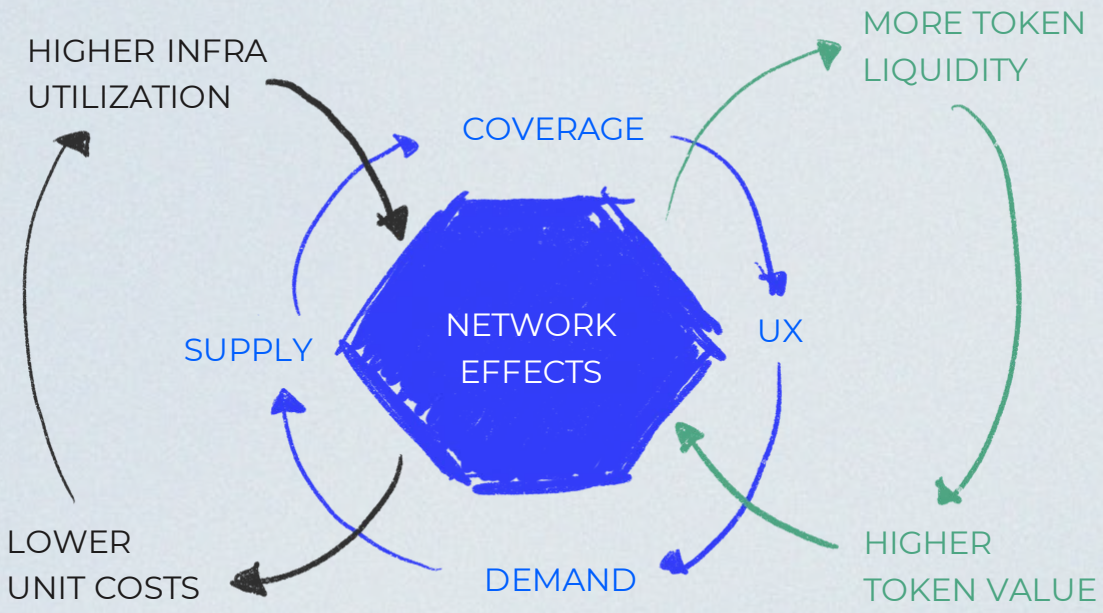
DECENTRALIZED CONNECTIVITY

Decentralized connectivity can be more efficient, resilient & performant than centralized infra.

Legacy Way of Building Networks	The Decentralized Way
CapEx Intensive: Extremely expensive proprietary equipment with vendor lock-in.	CapEx Crowdsourced: Financial rewards incentivize individuals to deploy commoditized, off-the-shelf hardware.
Labor Intensive: Operators hire technicians to install equipment.	Reduced Labor Cost: Plug-and-play hardware simplifies the installation process.
High Maintenance Costs: Field technicians must maintain equipment. Many Single points of failure.	Limited Maintenance: Hardware has warranty. Networks have increased resilience through redundancy.

Legacy Way of Building Networks	The Decentralized Way
Expensive Real Estate: Operators lease/buy placements for hardware deployments.	No Real Estate Cost: Individuals deploy hardware at properties they own.
OpEx Intensive: Operators maintain massive back-end infrastructure for billing, onboarding, customer support, etc.	Blockchain Automation: Blockchains permissionlessly coordinate participants. Back-end is automated on-chain.
Local Natural Monopoly: High costs limit competition.	Open access and Global Reach: Anyone can build networks in parallel around the world.
Expensive Flat-Rates: Limits the feasibility of low marginal value use cases.	Pay-as-you-go Model: New payment model unlocks a multi-billion dollar market.
Fixed Coverage: Network coverage is dictated by the network operator.	Flexible Coverage: Individuals can solve their own coverage issues.

DECENTRALIZED CONNECTIVITY FLYWHEEL



1. Increased Usage: As more people use the network, the demand for its services grows.

2. Token Price Rise: With increased demand, the value of the token naturally increases.

3. Contributor Incentive: The rising token value makes it more attractive for people to contribute resources to the network. They're earning tokens that are now worth more.

4. Network Expansion: As more resources are contributed, the DePIN network expands its capacity. This allows it to handle more users and offer a wider range of services.

5. Investor Interest: The network's growth and rising token value attract investors.

WHAT IS UPLINK?

Uplink is building an ecosystem, creating a self-sustained and infinitely scalable system that decentralizes both operational responsibilities and financial incentives across a broad spectrum of participants.

INVESTORS & AWARDS

AVALANCHE

e·on

Outlier Ventures

mustard seed

BLOCKCHANGE

edp

Framework

STRATOS

nxgen

AngelPad

· AngelPad Alumni · MarketWeek: “100 Most Disruptive Brands” Award

· Inc. Magazine: “30 Most Disruptive Companies”

· European Commission: EUtop50 Award

· Kairos Society: K50 Award

· Ericsson: Ericsson Garage Incubator Member

· European Commission: Next Generation Internet Award

· Vodafone: Vodafone PowerLab Member

2023 RESULTS

Initial results from running deployments in Latin America.

23%	Increase in local customers for our clients.
45%	Increase in Connected Devices
41%	Increase in Data Consumption

REACH OUT

Email

cl@uplink.xyz

Social Media

@carlosleisantos

Call me

+1 (917) 939-3972

Wireless Global Congress Americas

Prasanna Chamala

Director of Sales, Alethea Communications.

Real Application Performance with Wi-Fi 7- Data Driven Insights

alethea
Perfecting Broadband

Real Application Performance with Wi-Fi 7- Data Driven Insights

WGC Americas 2024
12th June

Prasanna Chamala
Prasanna.Chamala@alethetech.com

Agenda

- Introduction
  - Industry Specific Wi-Fi 7 Testing Priorities
  - Is Peak Performance important?
  - Ensuring Optimal User Experience with Wi-Fi 7: Testing Strategies
- Insights on User Experience with
  - Audio/Video Conferencing - Zoom, Teams
  - Video streaming - Youtube, Netflix

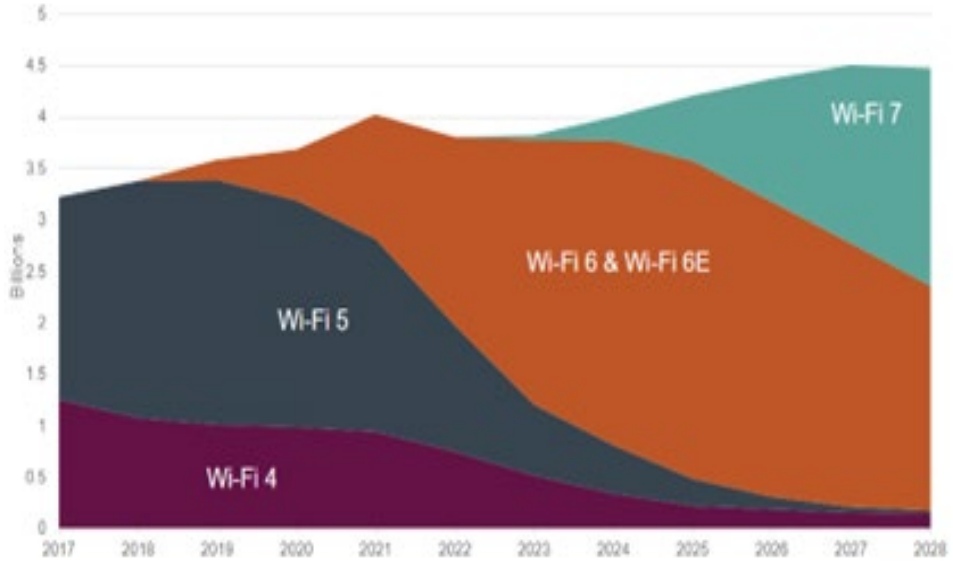
Why Wi-Fi 7?

Higher Data rates: Offers up to 46 Gbps

Lower Latency: Enhanced responsiveness is crucial for real-time applications such as gaming, video conferencing, VR etc

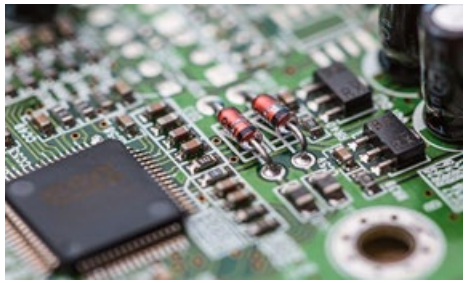
Better Efficiency: Supports more simultaneous connections, improving performance in dense environments

Improved QoE: Prioritizes critical applications, ensuring smoother experiences



Wi-Fi device shipments by generation from 2017 – 2028
(Image from Wi-Fi Alliance)

Industry Specific Wi-Fi 7 Test Focus



OEM/ODM

Peak Data Rates
Functionality
Scale
Stability

Service Providers

Peak Data Rates
Stability
Beacon Sanity
Roaming
Legacy Clients
InterOp

Moving Networks

Scale
Legacy APs
InterOp with Wi-Fi 7 clients

Enterprises

Improvement in QoE with Wi-Fi 7

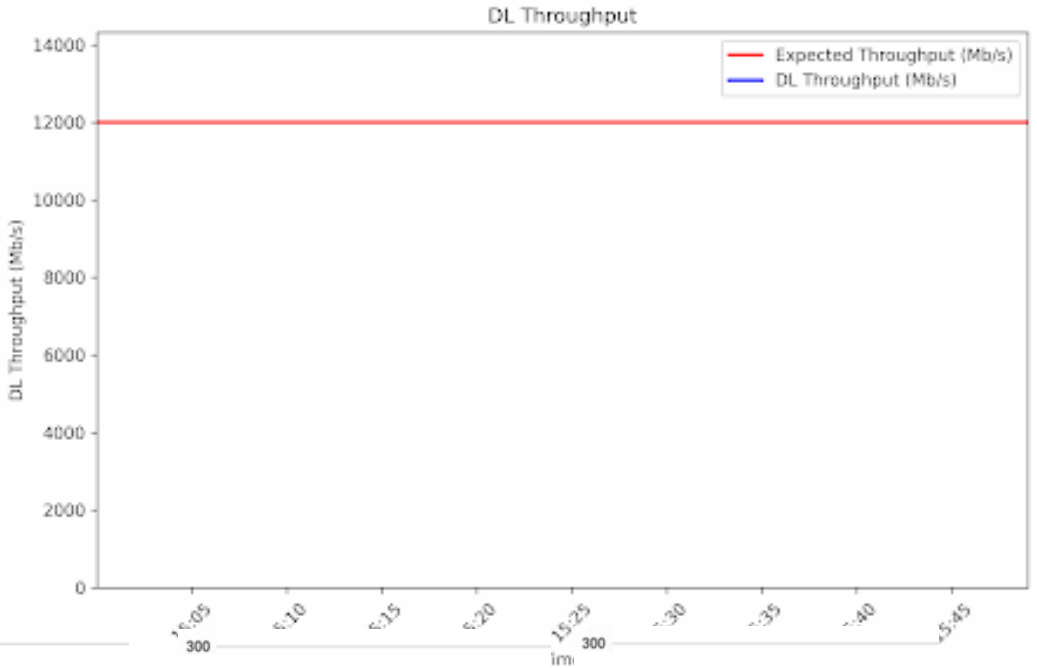
Wi-Fi 6 vs Wi-Fi 7: Peak Data Rates

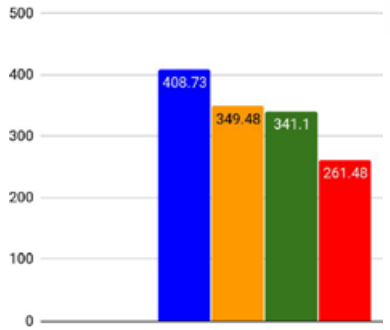
Alethea
Perfecting Broadband

Data Rates	Theoretical (Gbps)	Current Practical (Gbps)
Wi-Fi 6	9.6	3+
Wi-Fi 7	46	13+

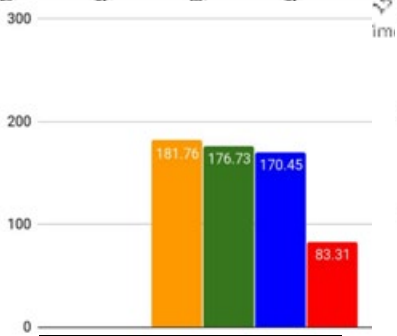
Peak performance ensures elimination of data plane issues, queue management problems, memory leaks, and memory copy inefficiencies

BUT IT IS NOT SUFFICIENT!

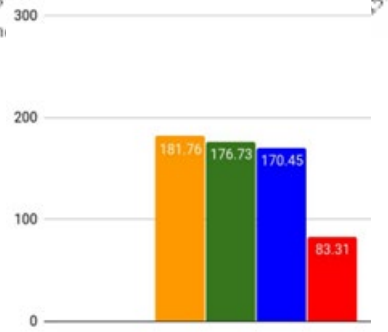




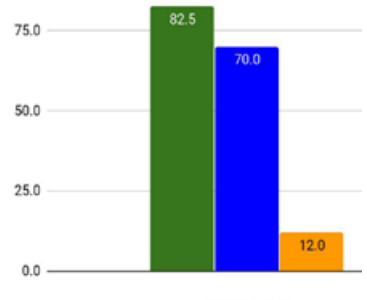
IPerf 32 clients



IPerf 100 clients



Throughput



Video Streaming

Test Strategy

a) Ensure functionality and peak results
b) Stability at scale
c) Achieve real applications QoE
d) Ensure interop with real clients

Test setup:

- Generated scale of 50 clients
- Run iPerf traffic on each client to load the Access Point
- Run real world application with mix of real devices
- Measure QoE of real applications on real devices

Test Setup - WiCheck

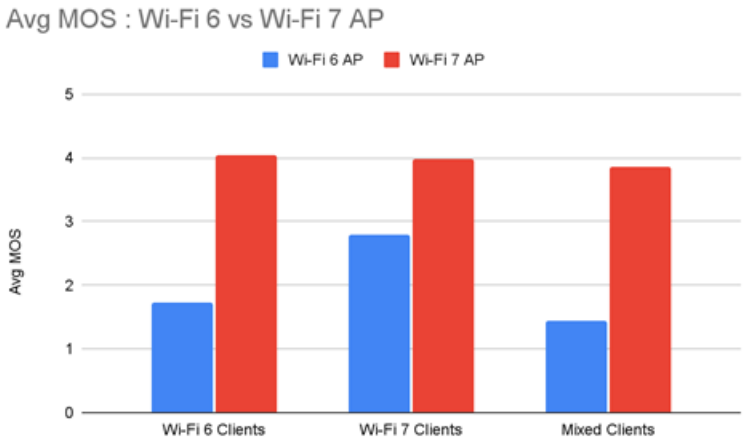
Great User Experience, Consistently at Scale

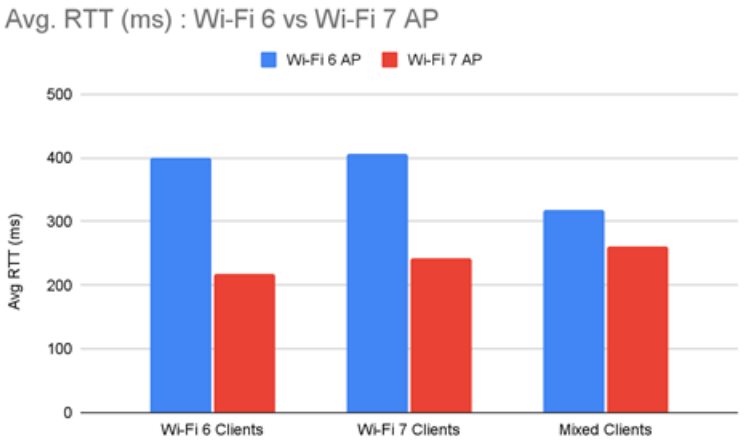
Real Applications

Real Clients

Real Scale

Zoom Performance & QoE





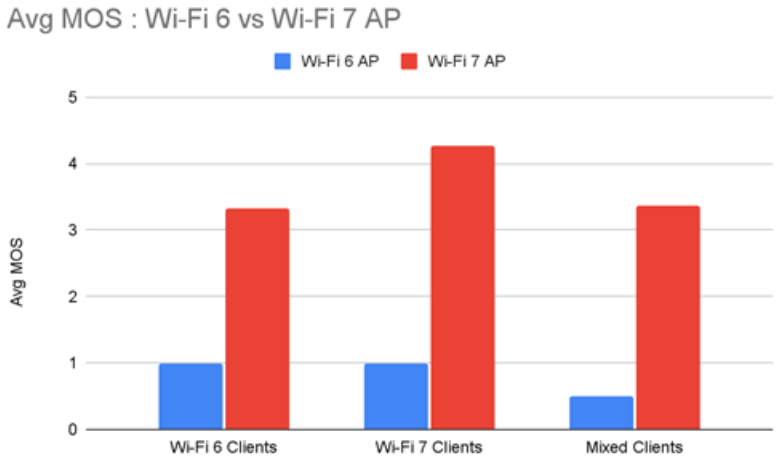
QoE KPI: MOS

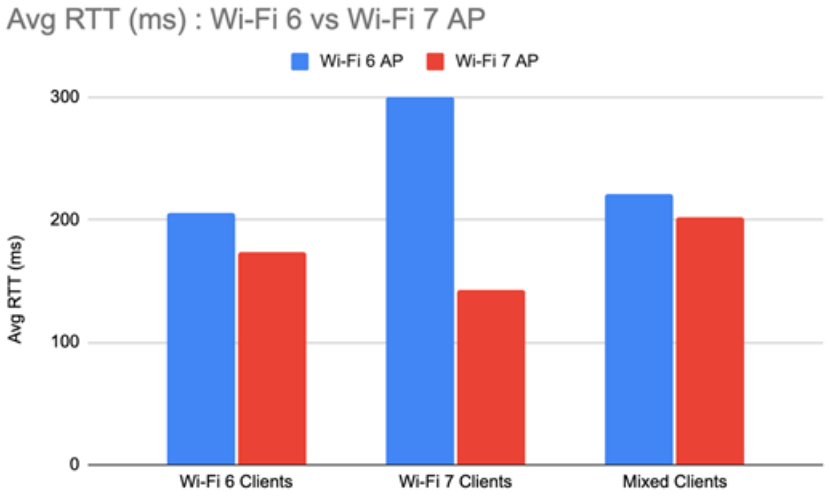
QoS KPI: RTT, Packet Loss

	Wi-Fi 6 AP		
Metric	Wi-Fi 6 Clients	Wi-Fi 7 Clients	Mixed Clients
Average RTT (ms)	399.57	407.06	318.37
Average Packet Loss %	10.27	0.83	24.56
Average MOS	1.72	2.8	1.44

	Wi-Fi 7 AP		
Metric	Wi-Fi 6 Clients	Wi-Fi 7 Clients	Mixed Clients
Average RTT (ms)	217.02	242.68	260.74
Average Packet Loss %	0	0	0
Average MOS	4.04	3.99	3.86

Microsoft Teams performance & QOE





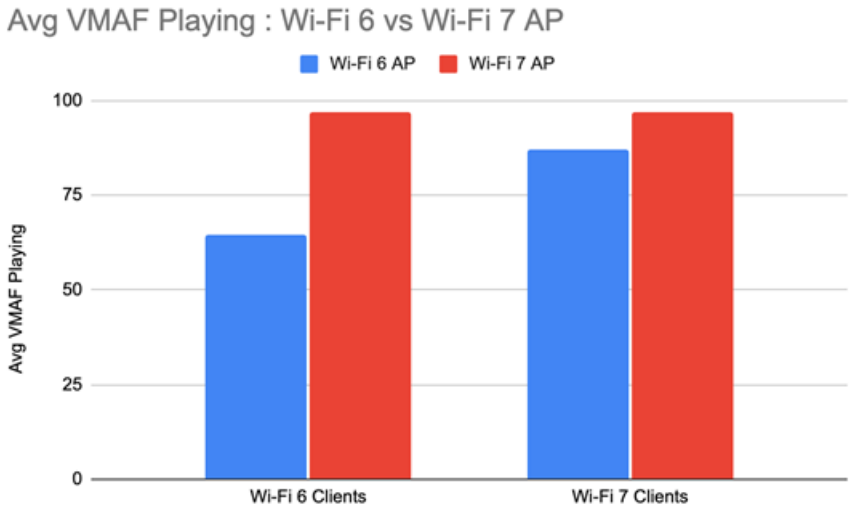
QoE KPI: MOS

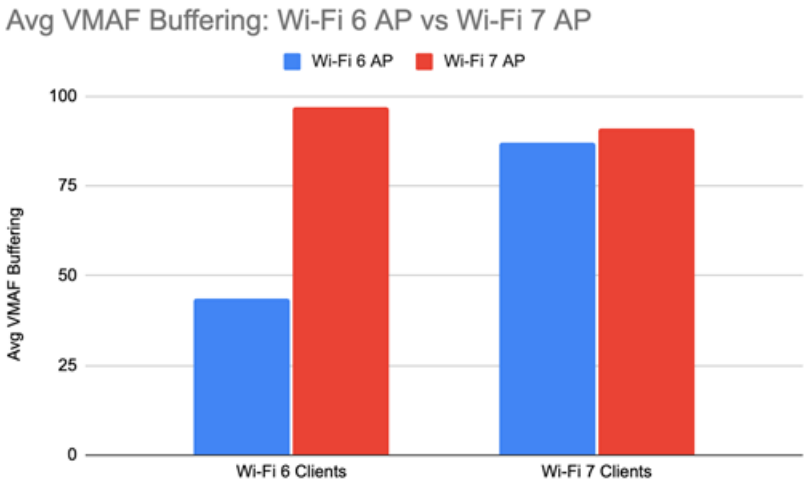
QoS KPI: RTT, Packet Loss

	Wi-Fi 6 AP		
Metric	Wi-Fi 6 Clients	Wi-Fi 7 Clients	Mixed Clients
Average RTT (ms)	205.5	300	221.5
Average Packet Loss %	14.18	35.85	21.62
Average MOS	1	1	0.5

	Wi-Fi 7 AP		
Metric	Wi-Fi 6 Clients	Wi-Fi 7 Clients	Mixed Clients
Average RTT (ms)	174	143	202.2
Average Packet Loss %	0	0	0.03
Average MOS	3.32	4.27	3.37

Netflix Performance & QoE





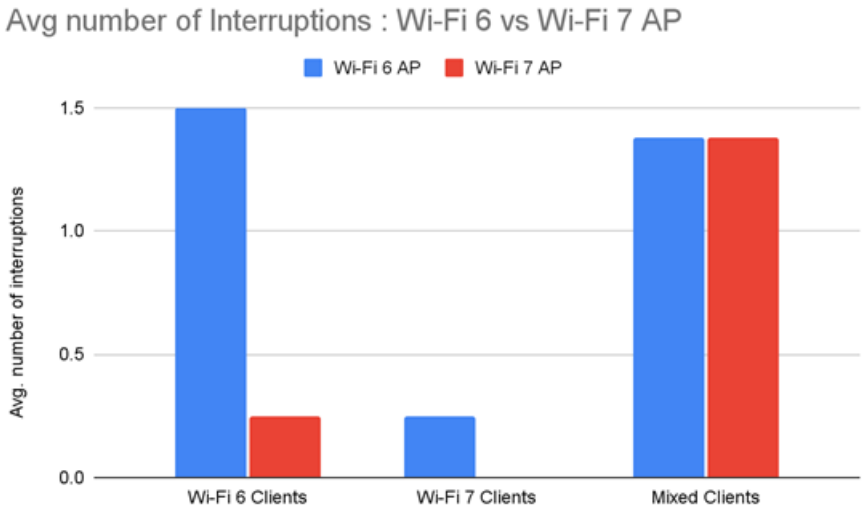
QoE KPI: VMAF Score (Full Reference Video Quality Predictor)

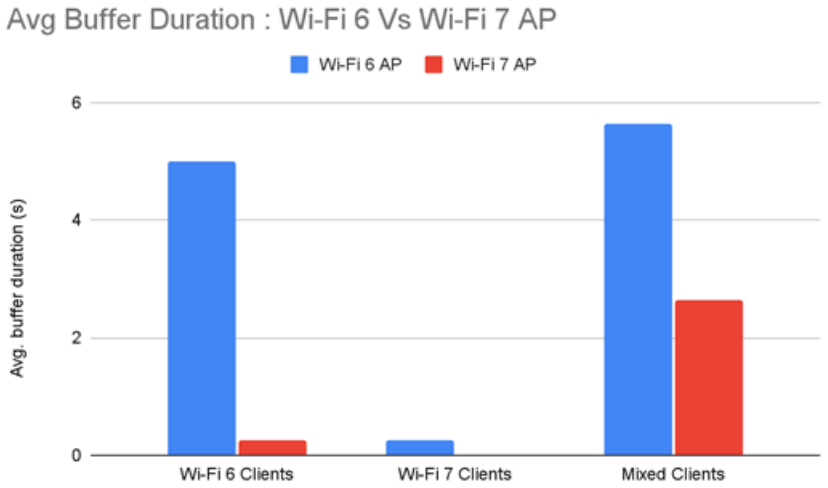
QoS KPI: Displayed Frames, Dropped Frames, Throughput

	Wi-Fi 6 AP	
Metric	Wi-Fi 6 Clients	Wi-Fi 7 Clients
Avg VMAF Playing	64.5	87
Avg VMAF Buffering	43.5	87
Avg Total Dropped Frames	0	2

	Wi-Fi 7 AP	
Metric	Wi-Fi 6 Clients	Wi-Fi 7 Clients
Avg VMAF Playing	97	91
Avg VMAF Buffering	97	91
Avg Total Dropped Frames	3	1

Youtube VR Performance & QoE





QoE KPI: Interruptions, Buffering, Load Time & Resolution

QoS KPI: Not Measured

	Wi-Fi 6 AP		
Metric	Wi-Fi 6 Clients	Wi-Fi 7 Clients	Mixed Clients
Interruptions	1.5	0.25	1.38
Buffering Duration (s)	5	0.25	5.63
Load Time (s)	2.15	1.47	3.31
Resolution	720p	1080p	1080p

	Wi-Fi 7 AP		
Metric	Wi-Fi 6 Clients	Wi-Fi 7 Clients	Mixed Clients
Interruptions	0.25	0	1.38
Buffering Duration (s)	0.25	0	2.63
Load Time (s)	6.53	0.89	4.62
Resolution	480p	720p	1080p

Conclusion

- In demanding environments where the Wi-Fi network is pushed to its capacity and load limits, real-world performance still has room for improvement
  - There are promising advancements with Wi-Fi 7, even at this early stage
  - Testing what truly matters—real scale, real clients, and real applications—is essential
- Ensuring a consistently great user experience at scale is key to unlocking the full value of Wi-Fi 7's exciting technical advances

About Alethea

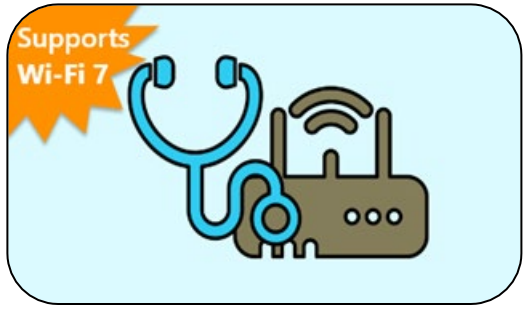
- **Alethea**
  - Established in 2010
  - Goal of advancing and promoting broadband technologies
  - Headquarters Bangalore; with offices also in San Diego
- **Team**
  - Team of ~160; passionate about broadband technology
- **Mission**
  - Developing innovative products and services to promote the global proliferation and success of Broadband
- **Customers**
  - Global customer base including major players within the broadband technology ecosystem from development to deployment
  - Serve OEM/ODM, Service Provider, Transportation and Enterprise Customers

Alethea Culture - Giving Back to Community

- **Promoting broadband technology in industry forums**
  - Wi-Fi Alliance, Wireless Broadband Alliance and Broadband Forum
  - Wi-Fi Knowledge Summits in India
- **Promoting corporate community service activities**
  - Reforestation
  - Education
  - Persons with disability
  - Research and development

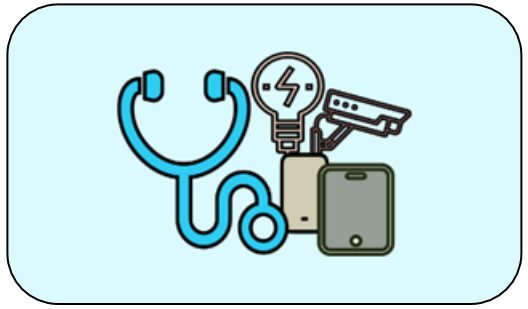
Thank You

www.aletheatech.com
info@aletheatech.com



WiCheck

The Universal Wi-Fi test solution



WiSure

Wi-Fi Device Test Solution

Services

Test Lab
Test Automation
Test Applications

Associations

Wireless Broadband Alliance | broadband forum | Qualcomm ADC | Member Wi Fi Alliance | BIF Broadband India Forum "Think Tank for Digital Transformation"

Wireless Global Congress Americas

Jonah Ross

Manager, Program Management Office,
Wireless Broadband Alliance.

Panel Moderator

Wireless Global Congress Americas

Panel: Enabling new Business Cases with Wi-Fi Halow

Paul Lai

CEO,
AsiaRF.

Zac Freeman

EVP, Sales & Marketing,
Newracom.

Prakash Guda

VP Product & Marketing.
Morse Micro.

Wireless
Global Congress
Americas

George Hechtmann

Principal, Hechtman Venture Development.

Panel Moderator

Wireless Global Congress Americas

Panel: Addressing new business opportunities for operators and service providers

Bernard Herscovici

President,
NetExperience.

Rajat Ghai

Vice President. Xfinity Wi-Fi Engineering,
Comcast.

Russ Keveryn

Senior VP of Sales,
RouteThis

Wireless Global Congress Americas

WGC AMERICAS

CONNECTING OUR DIGITAL WORLD

COFFEE BREAK & NETWORKING
BE BACK IN 35 MINUTES AT 4.25 PM CT

Wireless Global Congress Americas

Reza Jafari

Chairman & CEO, E-Development International;
Board Advisor to the Wireless Broadband Alliance.

Session Moderator

Wireless Global Congress Americas

Time	Presentation
4:25 PM (CT)	**Moderator Introduction** Reza Jafari, Chairman & CEO, e-Development International and Board Advisor to the Wireless Broadband Alliance.
4:30 PM (CT)	**Boldyn Networks, Keys to the City of the Future - An Introduction to LinkNYC and Roma5G** Andy Penley, Group CTO, Boldyn Networks.
4:50 PM (CT)	**Last Mile Connectivity Solutions addressing the needs of Communities.** Vince Aragona, President & CEO, Neo Network Development.
5:10 PM (CT)	**OpenRoaming: Simplifying Citizen Access in Wi-Fi Connected Communities** Betty Cockrell, Director Service Provider Products, Single Digits.
5:20 PM (CT)	**Panel – Connected Communities Forum: Understanding the Challenges and Opportunities to Enable Smart and Connected Communities that Can Thrive.** Greta Byrum, Principal, Broadband & Digital Equity, HR&A; Mark Miller, Co-Founder & President, Cutting Edge Telecommunications; Mittal Parekh, Senior Director, Product Marketing, Technical Marketing and Influencer Marketing, RUCKUS Networks; Alphonso Jenkins, Connected Cities Forum Advisor to the Wireless Broadband Alliance.
5:50 PM – 5:55 PM (CT)	**DAY 1 Closing Remarks** Tiago Rodrigues, President & CEO, Wireless Broadband Alliance
6:00 PM - 8:00 PM (CT)	DRINKS & NETWORKING RECEPTION – THE ATRIUM, PLAZA OF THE AMERICAS.

Wireless Global Congress Americas

Andy Penley

Group CTO, Boldyn Networks

Boldyn Networks Keys to the City of the Future

An Introduction to LinkNYC and Roma5G

BOLDYN NETWORKS
KEYS TO THE CITY OF THE FUTURE

17 JUNE 2024

An Introduction to LinkNYC and Roma5G

boldyn NETWORKS

UNLOCKING THE POWER OF AN INTERCONNECTED FUTURE

Boldyn Networks is one of the largest neutral host providers in the world. Our shared network infrastructures and cutting-edge connectivity solutions are the building blocks for an interconnected future – for everyone.

30+ years in communications in North America and Europe

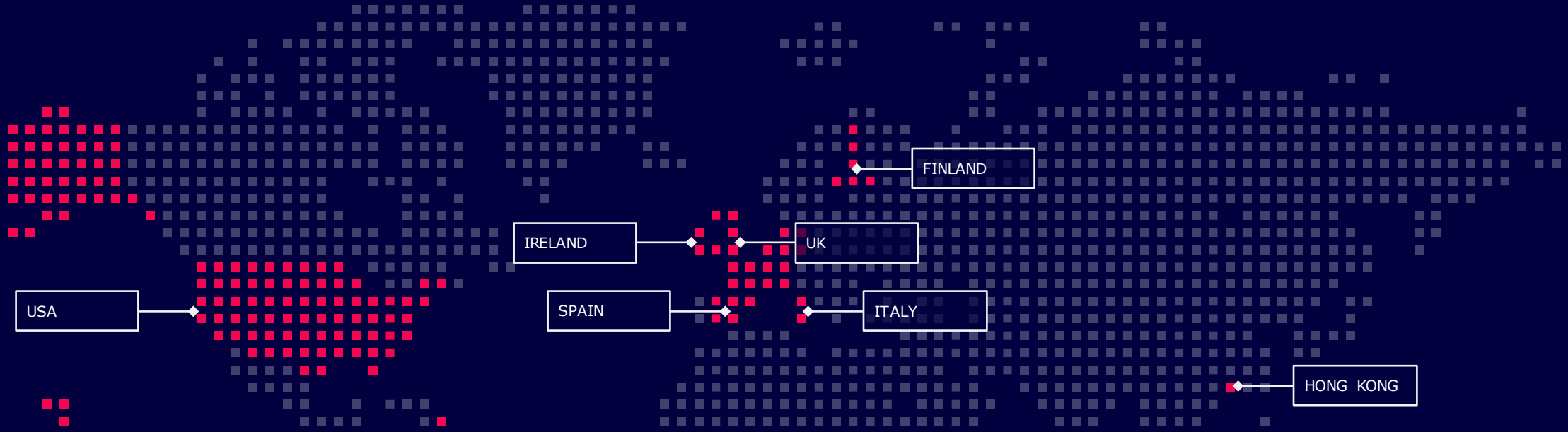
Presence in **3 continents**

Over **1,100+ employees** globally and access to **+2,000 partner staff**

Networks **connecting 6 billion rides** every year in **5 major transport networks**

5 major city networks connecting fibre, thousands of venues, transport and more.

Majority-owned by Canada Pension Plan Investment Board since 2009. A trusted long-term investor with C$632 billion net assets.



ENABLING SMART CITIES

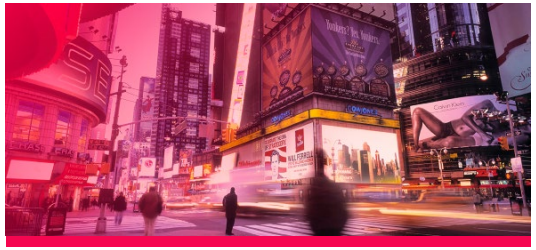
Working with network operators to extend their reach and advance networks in complex environments. Enabling Smart cities and closing the Digital divide.

Transport for London

Pioneering the Gigabit society

Using existing TfL routes, we are deploying fibre and small cells throughout the UK network capital. Extending the reach of fixed and mobile operators.

- 12 edge data centres across London
- 200km of dense fibre
- Connection to 80k small cells
- Connection to thousands of TfL street assets including:
- 22.2k bus shelters
- 45.9k lighting points
- 73.7k traffic management points



New York City

Networking the concrete jungle

Providing robust coverage and connectivity in urban areas, without disrupting the surrounding areas.

- Largest free public outdoor Wi-Fi network in the US, delivering free Wi-Fi to previously underserved neighbourhoods
- Deployed in the excess of 1,500 small cells across New York
- 12 million users connected with free internet access
- 1,750 route miles of fibre

Sunderland

Connecting the North

By 2030 Sunderland will be a smart city with ubiquitous connectivity throughout.

- Initial roll out of 1.7 km2 of 5G small cell deployment in city centre including public Wi-Fi
- Low power wireless network, for IoT devices, covering the whole 127 km2 council area
- Incorporating and enabling existing and future private networks, including those at the Nissan car plant

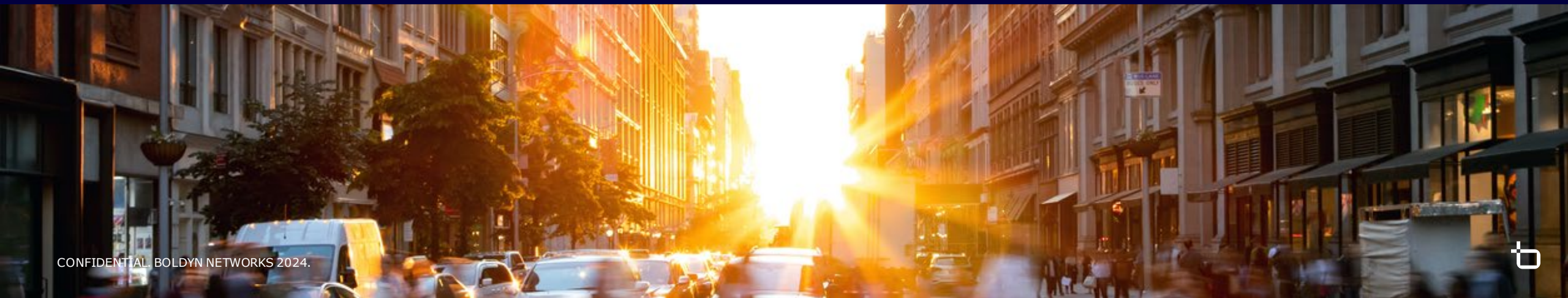
Rome

#ROMA5G: the eternal city's first advanced 5G infrastructure

25-year concession with the city of Rome to bring advanced 5G neutral host infrastructure to the city and connect 3 million citizens and over 15 million visitors every year.

- Metro:
  - 83 stations
  - 68 km of tunnels
- 2,000 small cells
- 100 public square
- Citywide Wi-Fi

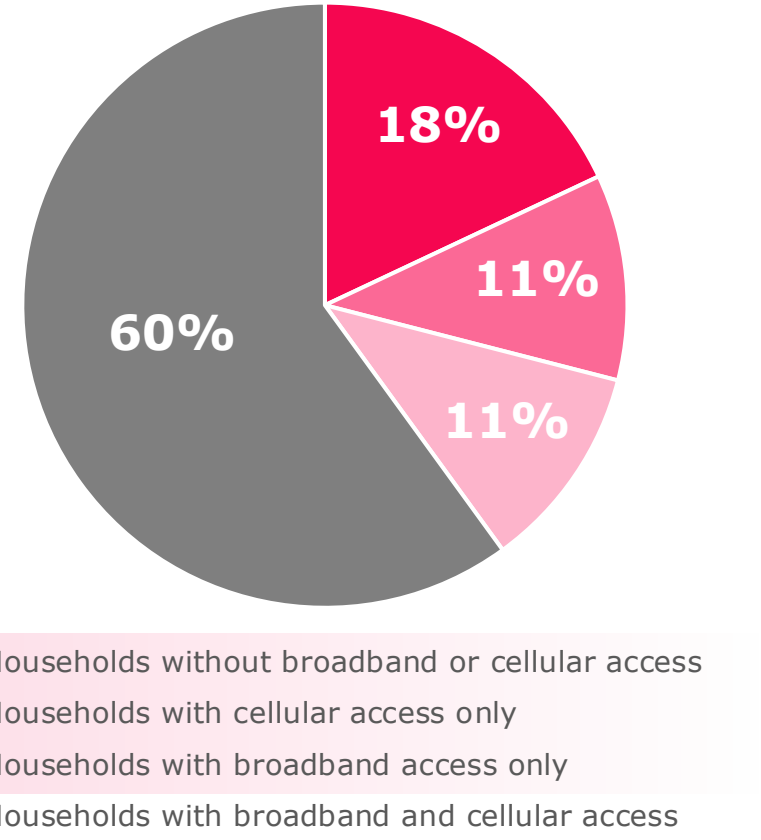
REBOOTING LINKNYC



THE CASE FOR LINKNYC

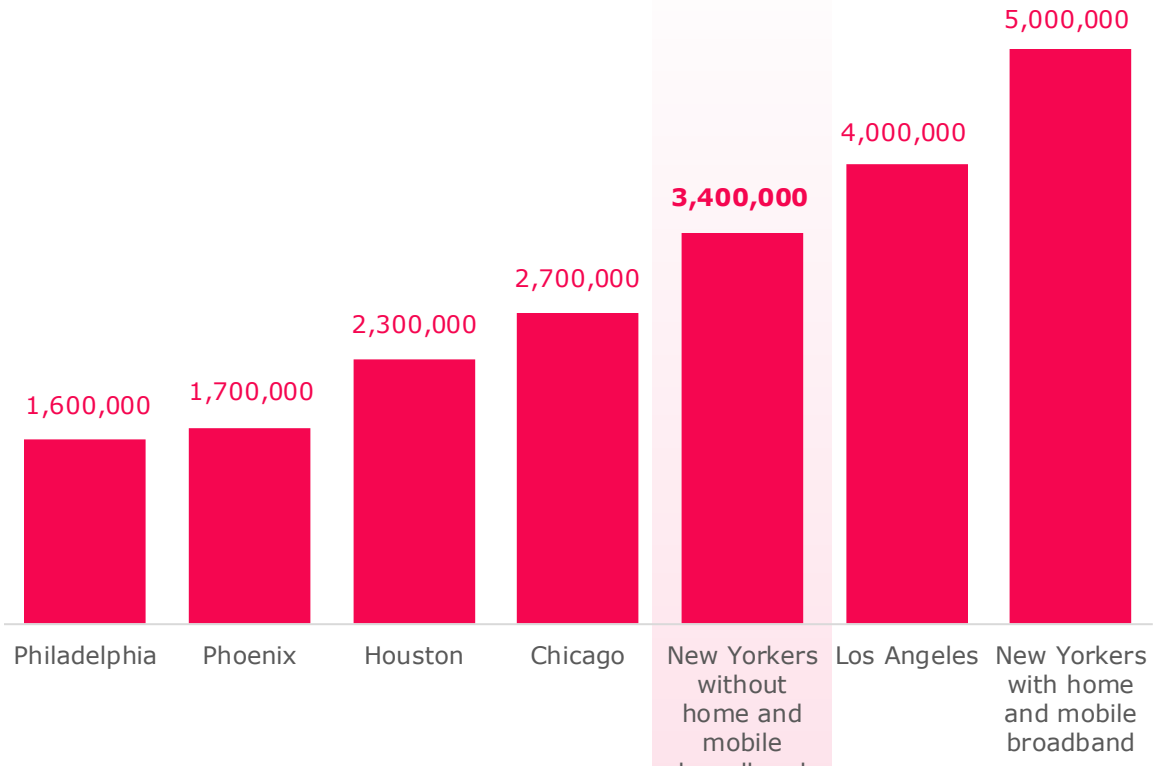
The digital divide in New York City

Households in New York City with home broadband or mobile broadband



Source: The New York City Internet Master Plan – Jan 2020

New York City's digital divide relative to other cities' total populations



Source: HR&A Advisors

HOW DOES LINKNYC PROVIDE FREE AND EQUITABLE ACCESS?

High-speed, free public Wi-Fi throughout NYC

Free nationwide digital calling

- 911 / 311 access
- Access to all social services hotlines
- Video-relay service for deaf and hard-of-hearing community

Access to government and social services websites

Advertising space for the City, community information, and local businesses

USB port for free charging of mobile devices

PEOPLE USE THE LINKS!

The largest free public Wi-Fi network in the U.S in Manhattan has seen….

10,000 people a month accessed Aunt Berth social services directory

5M calls made since 2020

15.8M Wi-Fi Subscribers have moved over 42,000 TB of data

LINKNYC

How does Boldyn & Link5G Fit in?

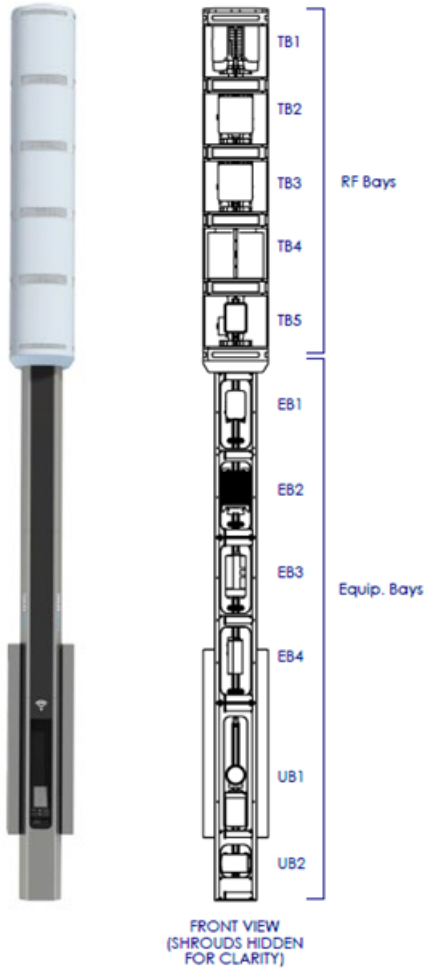
- NYC was pursuing several efforts to expand high-speed broadband and cellular network access in all five boroughs, and both efforts are buoyed by the Link reboot.
  - The City's initiative to leverage street-level assets to expand the City's fiber network will benefit from the fiber run to each new Link installed
  - The build-out of 5G to ensure broadband-like speeds for cellular users required street poles, but greater saturation through Link helps expand 5G to the outer-boroughs using Neutral host infrastructure

Link5G is a valuable asset in the expansion of broadband and cellular network access in NYC.

INTRODUCING LINK5G

LINK5G DESIGN EXPANDS BROADBAND INFRASTRUCTURE

TB1	Millimeter Wave Bay for Operator 1 Ultra-Fast 5G Service	Ultra-Fast 5G Services from multiple providers, giving NYers freedom of choice and the fastest possible wireless services
TB2	Millimeter Wave Bay for Operator 2 Ultra-Fast 5G Service	Ultra-Fast 5G Services from multiple providers, giving NYers freedom of choice and the fastest possible wireless services
TB3 + TB4	Millimeter Wave Bay or Sub 6 GHz Shared Bay for 4G LTE + 5G for additional coverage and capacity for CBRS and/or IOT to support neutral host providers and technologies	Coverage and capacity at Sub 6GHz bands, while alternative technology offerings increase competitive landscape and open doors to alternative wireless providers for NYers
TB5	Optimized Wi-Fi structure and siting locations improve coverage and performance of free public gigabit Wi-Fi	Improved free public Wi-Fi Service
EB1 to EB4	Operator Equipment	Safe, secure, efficient use of space to house required radio equipment concealed from view
UB1 + UB2	LinkNYC Wireless Services Equipment, Pole controls and connection to fiber and power	Provides critical public City services



Below ground fiber infrastructure that can be used by other carriers to deliver connectivity throughout NYC

LINK5G DESIGN IMPROVES ALL FORMS OF CONNECTIVITY

Multi-tenant, multi-service means New Yorkers have access to the most available wireless technologies

More wireless access = better connectivity options for more people

Wi-Fi and other technologies such as 4G/5G cellular and CBRS are complementary, not substitutes

- Overlapping coverage means connectivity is always available
- Different services are used for different purposes by different users
- Different services provide different classes of service and continuity for users moving across the City

"A gigabyte is a gigabyte, no matter how it gets over the air. We need both Wi-Fi and our cellular network in New York to give our users consistent, reliable service." Global Connection Management at a major carrier

LINK5G ADDRESSES THE DIGITAL DIVIDE

40% of New York City households lack the combination of home and mobile broadband, including **18%** of residents — more than **1.5** million people — who lack both

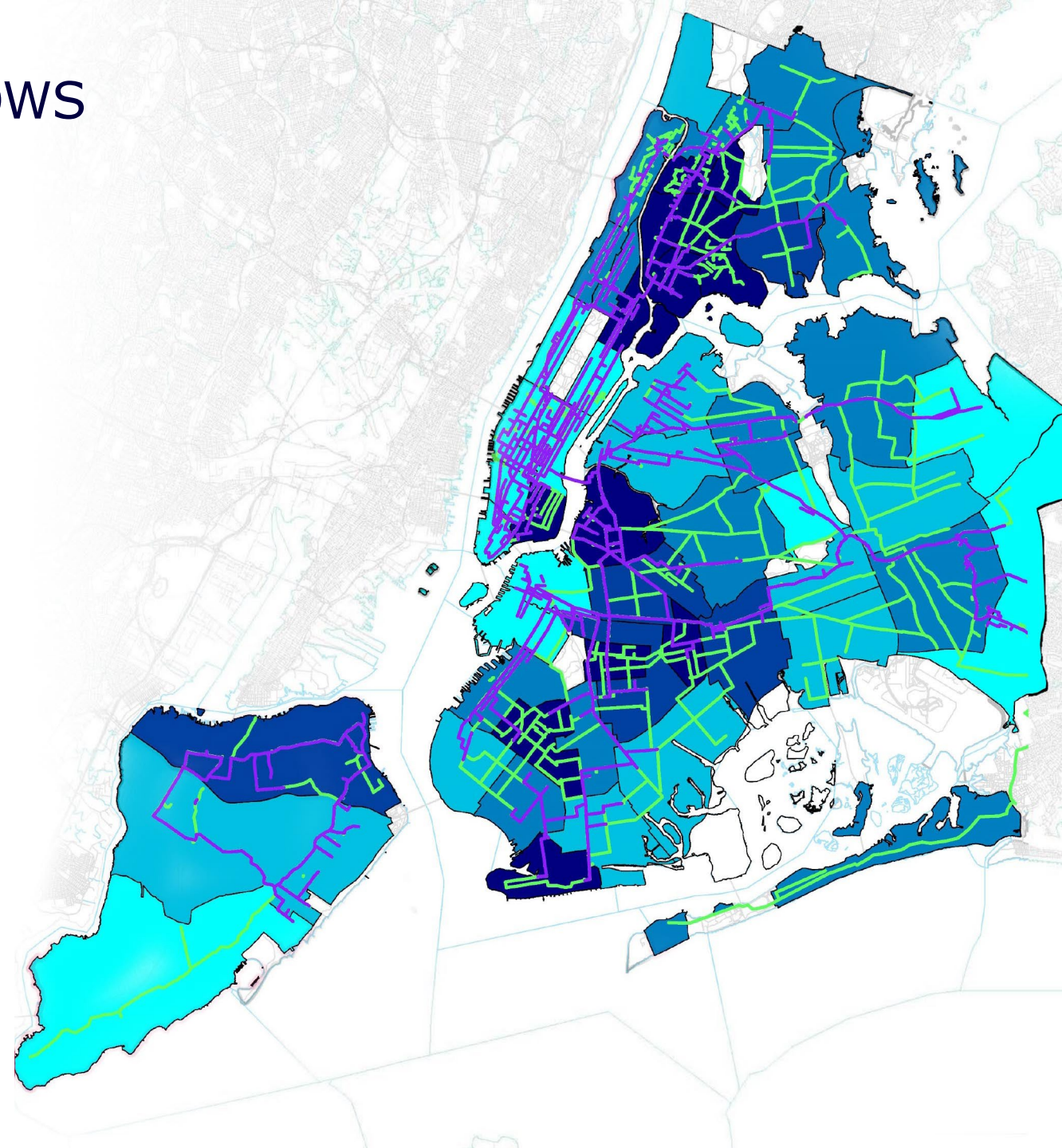
In response to a survey of LinkNYC Wi-Fi users during the COVID pandemic, **30%** reported no other access to broadband internet, even with most kiosks in Manhattan

Link5G will expand the free LinkNYC Wi-Fi network and bring mobile broadband and fiber infrastructure directly to underserved communities

WHERE LINK5G GOES, FIBER FOLLOWS

Over 25% of capital commitment will be invested in fiber infrastructure to extend connectivity to every community district in New York City.

By building fiber across the outer boroughs and above 96 Street, CityBridge's strategic investor, Boldyn Networks, can leverage that fiber to expand the City's usable broadband fiber footprint.



#ROMA5G

HIGH LEVEL FRAMEWORK OF #ROMA5G

Metro

Coverage of all metro lines (A, B, C), stations and tunnels, with 4G and 5G bands

Public Wi-Fi

Development of the **free Wi-Fi** network of Roma Capitale with about **850 points of presence distributed in 100 squares** of public importance

5G small cells (neutral host infrastructure)

Development of **passive infrastructure** for the city's 5G underlay coverage, based on small-cells to host all mobile operators

Smart City / video surveillance

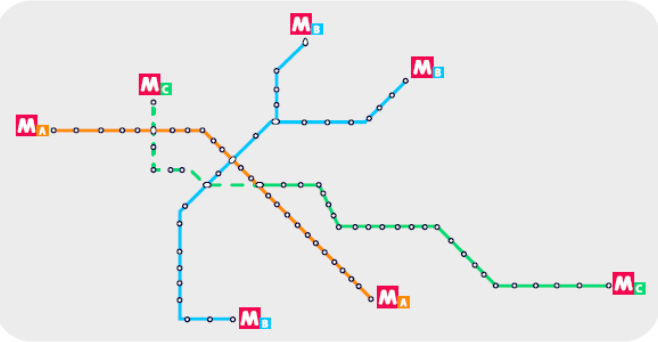
Equipping, installation and management of about **1,800 IoT sensors** and **2,000 high-resolution 5G cameras** for the development of Smart City solutions and environment management / control

ROMA CAPITALE

ROMA CAPITALE

boldyn NETWORKS

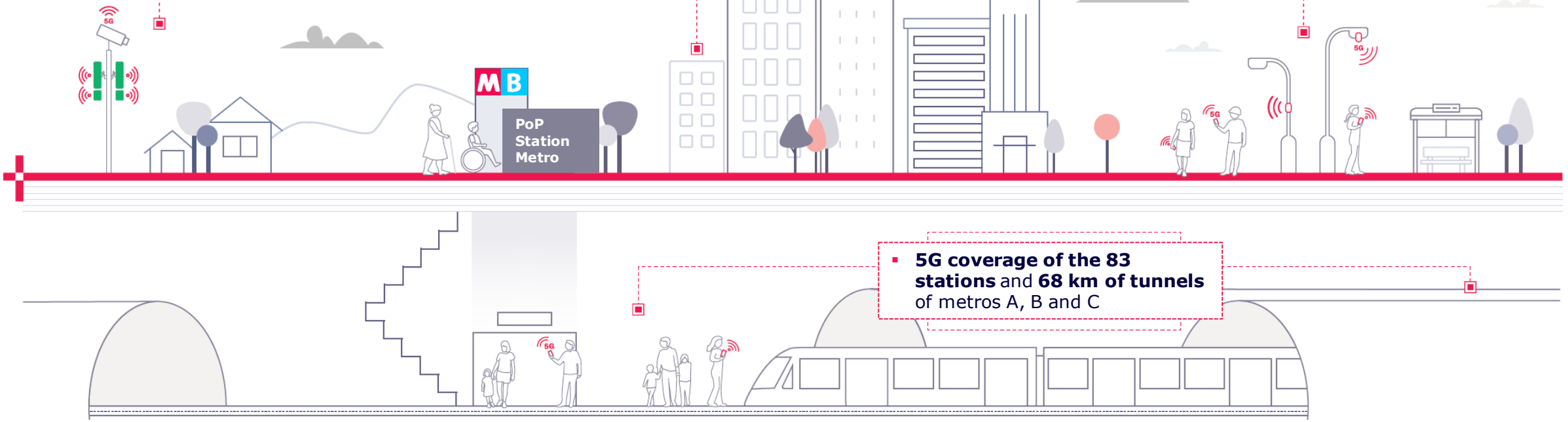
Metropolitana di Roma



- **2,000 High Definition Cameras** with 5G Connectivity for public safety
- Over **1,800 IoT Sensors & Modules**

- Improved indoor coverage for **5G for the largest 7 public buildings** of Roma Capitale

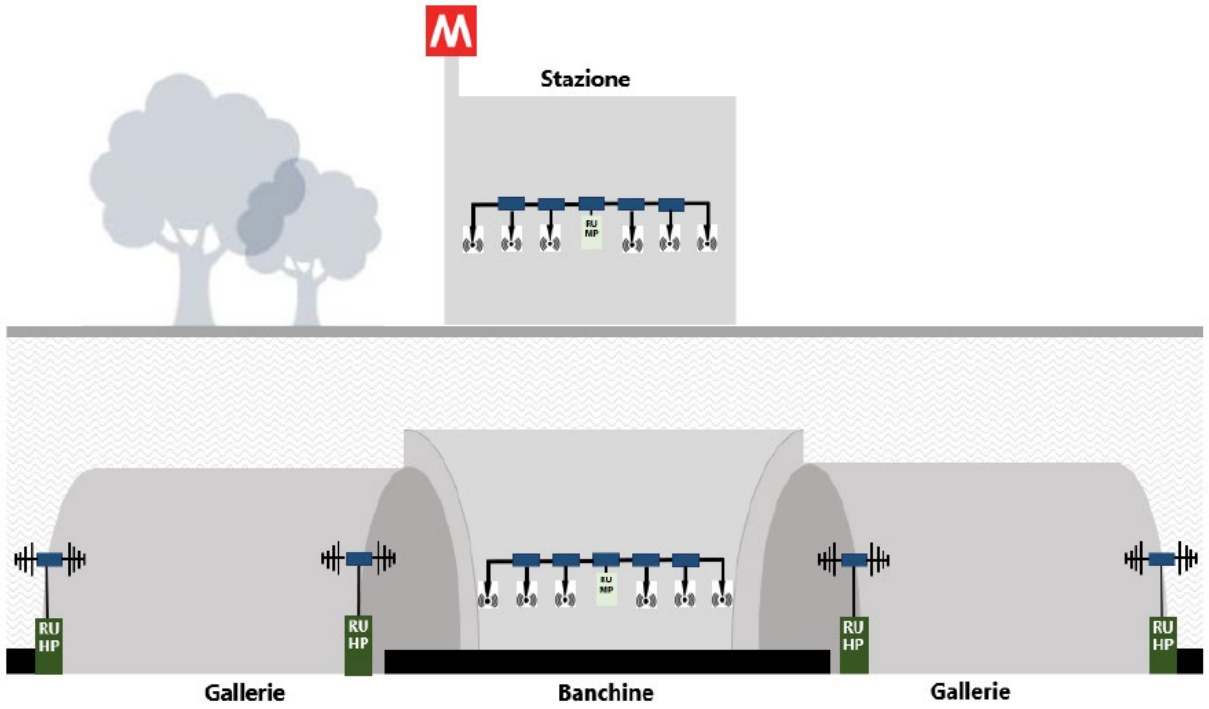
- Passive infrastructure for over **2,000 Small Cells**
- **Public Wi-Fi in 100 squares**



- **5G coverage of the 83 stations** and **68 km of tunnels** of metros A, B and C

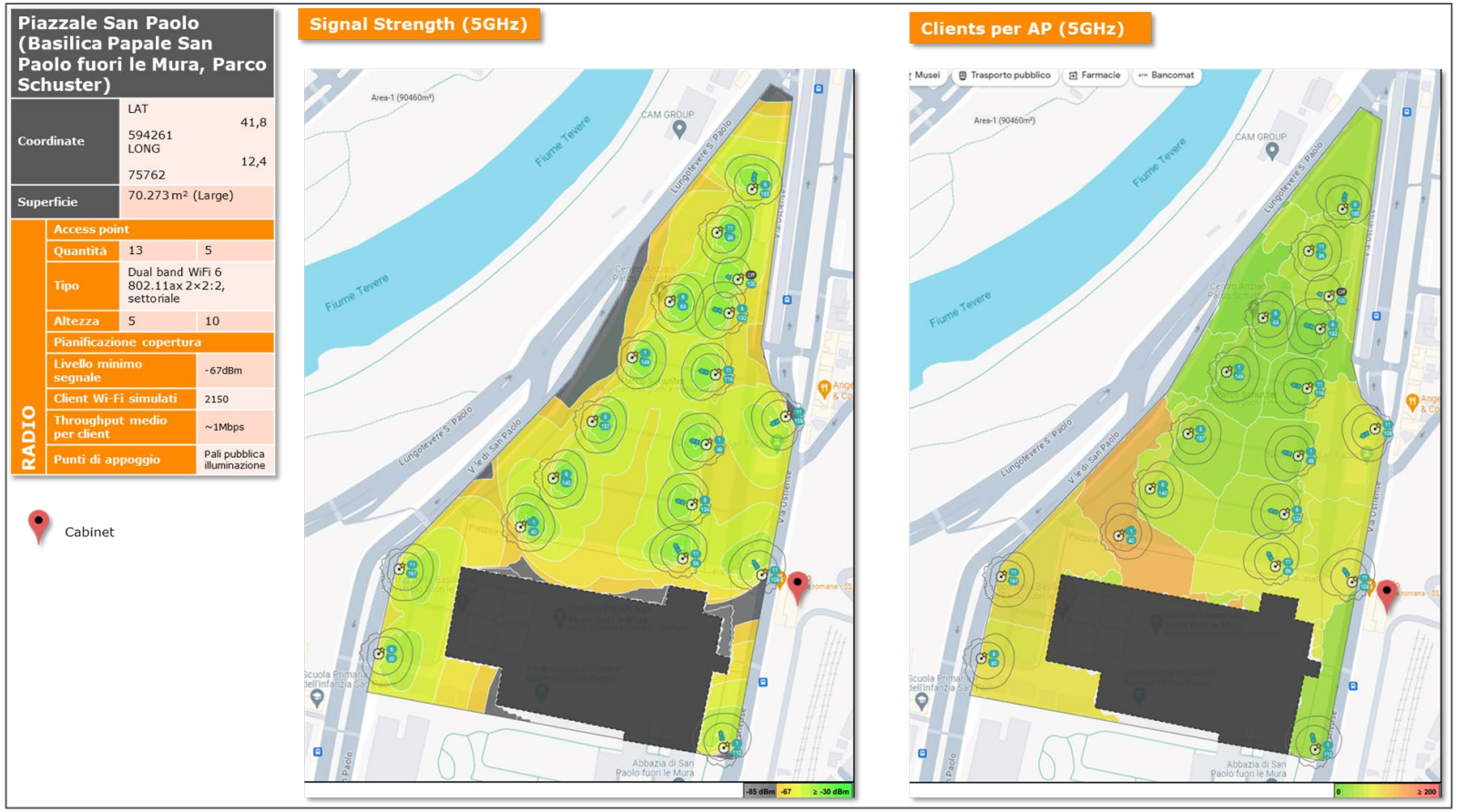
ROMA5G: METRO PROJECT

- Performance requirements and coverage goals co-developed with Roma Capitale and MNOs
- DAS solution in development that will see first deployments in 2024
- Boldyn, in cooperation with ongoing Metro development and Roma Capitale, will deploy to all underground stations and tunnels within the next 5 years



ROMA5G: SQUARES PROJECT

- 100 squares in total will receive free public Wi-Fi
- Boldyn will leverage the infrastructure developed for Wi-Fi deployment to install passive infrastructure to support 2,000 Small Cells
- Squares infrastructure will also be leveraged to deploy municipal closed-circuit cameras and IoT sensors



High Level Design Example: Piazzale San Paolo

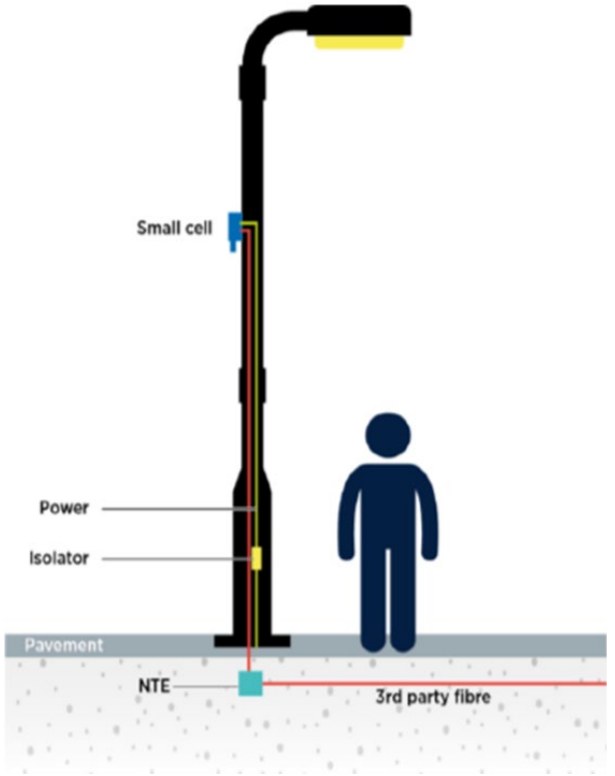
5G SMALL CELLS INFRASTRUCTURE FOR #ROMA 5G

Target

- Develop a **passive underlay infrastructure**, complementary to the existing overlay one, to **densify the 5G signal and enable Smart City solutions**
- The development of this infrastructure, beyond the places of public interest indicated by the Municipality of Rome, will be agreed with the MNOs, based on the needs of their development plans and network planning

Proposed solution

- The Municipality of Rome will provide more than 200,000 light poles, about 3,000 traffic light systems, bus station shelters, etc. The availability of such existing infrastructure will allow for the efficient and effective development of underlay infrastructure

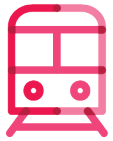


ROMA5G: PROGRAM SUMMARY

- The City of Rome is one of the first administrations in Europe to invest in the development of a passive infrastructure to accelerate 5G; public contribution 35% (both cash and in kind) of the total project capex.
- 7 – 10 million tourists visit Rome each year
- Rome Metro average daily ridership is 820K
- Catholic Jubilee begins January 2025; anticipated to bring in additional 35 million visitors over the course of the year
- Neutral host model enables much needed investment in local infrastructure through a PPP to make Rome a smarter and more connected city to improve the experience for its citizens and visitors

Project Elements Summary

Stations
83



Tunnels
68 Km

Small Cells
2,000

Squares
100

Municipal Buildings
7

IoT Modules
1,800

Cameras
2,000


THANK YOU
boldyn
NETWORKS

Wireless Global Congress Americas

Vince Aragona

Neo Network Development

Last Mile Connectivity Solutions Addressing the Needs of Communities

WARNING!

The Following Presentation Includes A Pragmatist View of the Problems, Solutions, Alternatives, Examples and Case Studies To Be Used To Encourage Debate and Promote Innovation Through Independent Thought. It Is Not Intended For Use as a Basis to Forge Any Formal Legal Opinion or Influence Any Particular Political Agenda Or Outcomes.

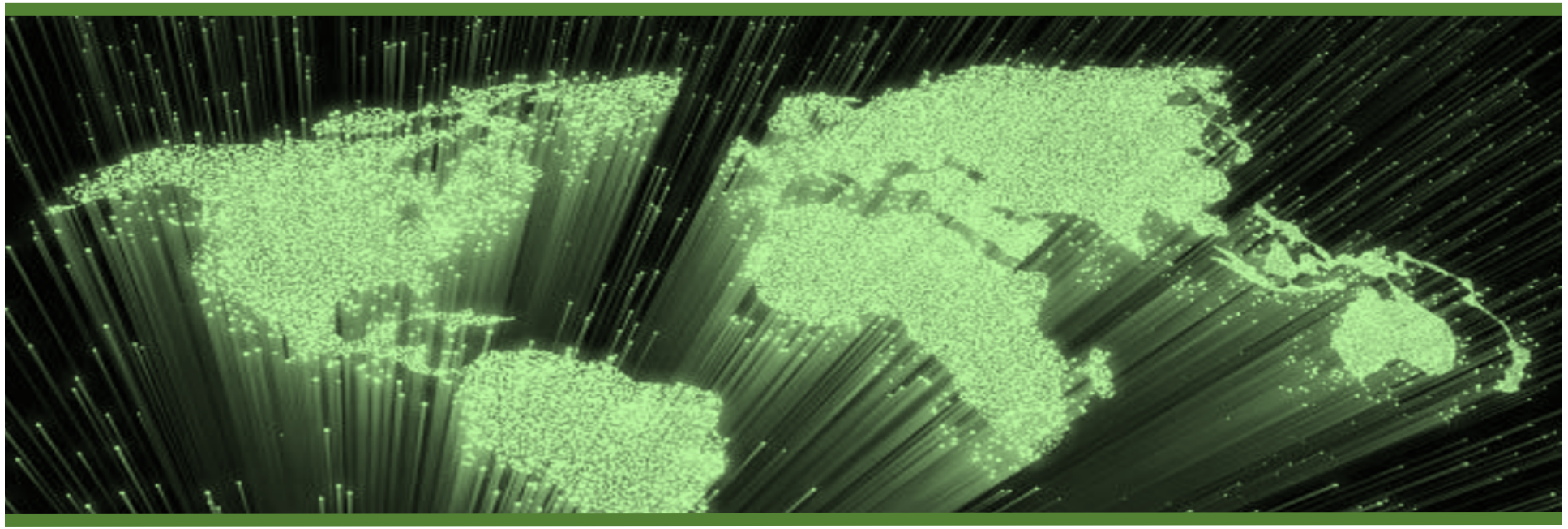
May Contain Strong Language and Honest Perspectives on the State of the State Of The Telecommunications Industry, Federal Government Lawmakers, Regulators, Policy Makers and Administrators Responsible for the Abuse of Public Funds, Violation of the Public Trust, Ignorance of the US Constitution and Fundamental Rule of Law.

Materials May Not Be Appropriate For Certain Elected and Appointed Public Officials Or Other More Sensitive Viewers.

For General Information, Reference and Guidance Purposes Only.

VIEWER DISCRETION IS ADVISED

In A Digital World

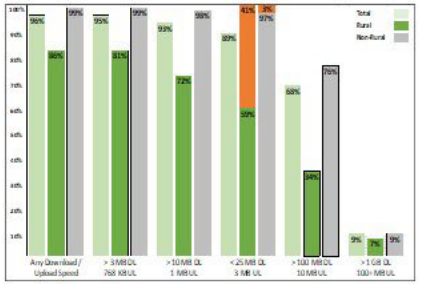


Fiber and Fiber Connected Infrastructure are King

Three Big Broadband Problems

No Internet Access

41% Rural



3% Non-Rural

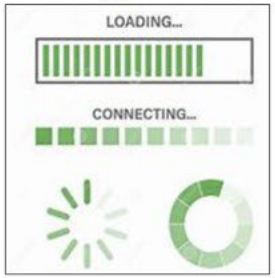
Affordability

53 Million = 41%

4 in 10 Are Trapped in the Affordability Gap

Speed

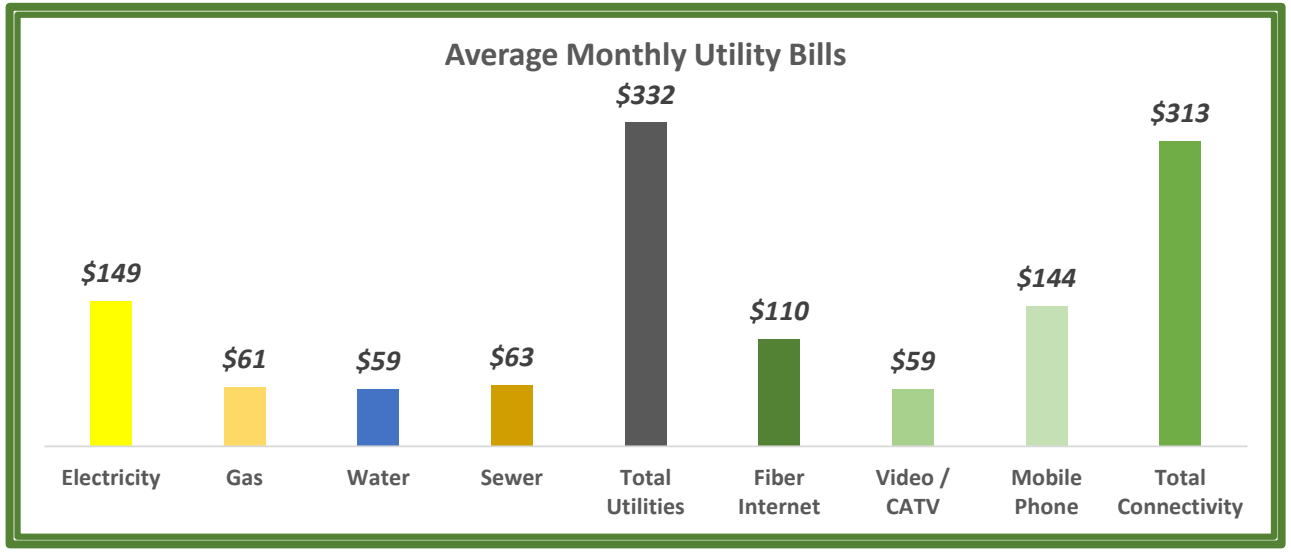
Existing Internet



Service Too Slow

The Average Family Today

Pays Almost As Much for Connectivity and Content Then All Other Utilities Combined



When A Residential Fiber Connection Cost Nearly Twice As Much as Water, Sewer And Gas

Something Has Clearly Gone Horribly Wrong

Broadband is Unaffordable *Because* It is Overpriced

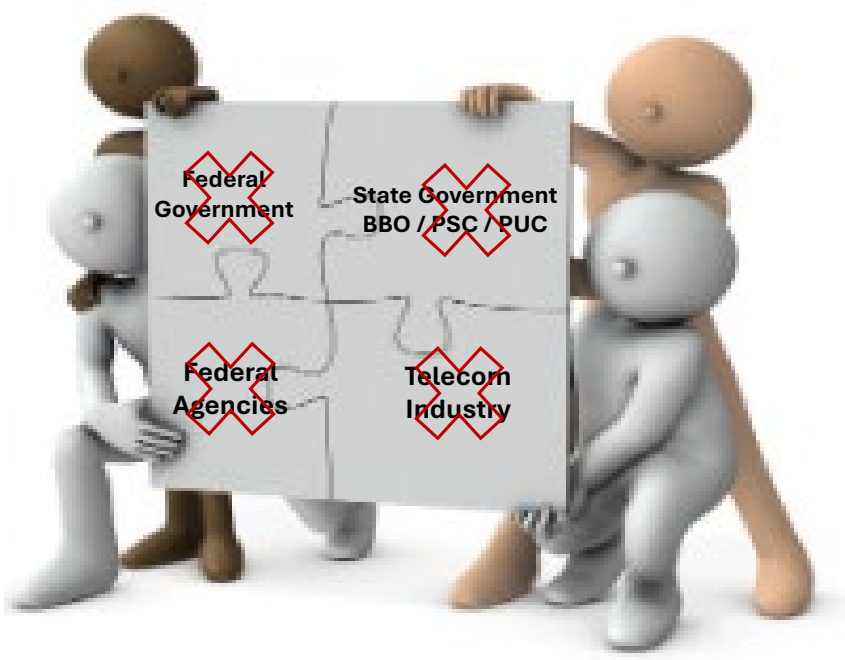
Impacts Digital Equity, Digital Literacy, Education, Healthcare, Participation in the Remote Workforce and the Digital Economy

$97

A Month

⇧

Problem



Solution

⇩

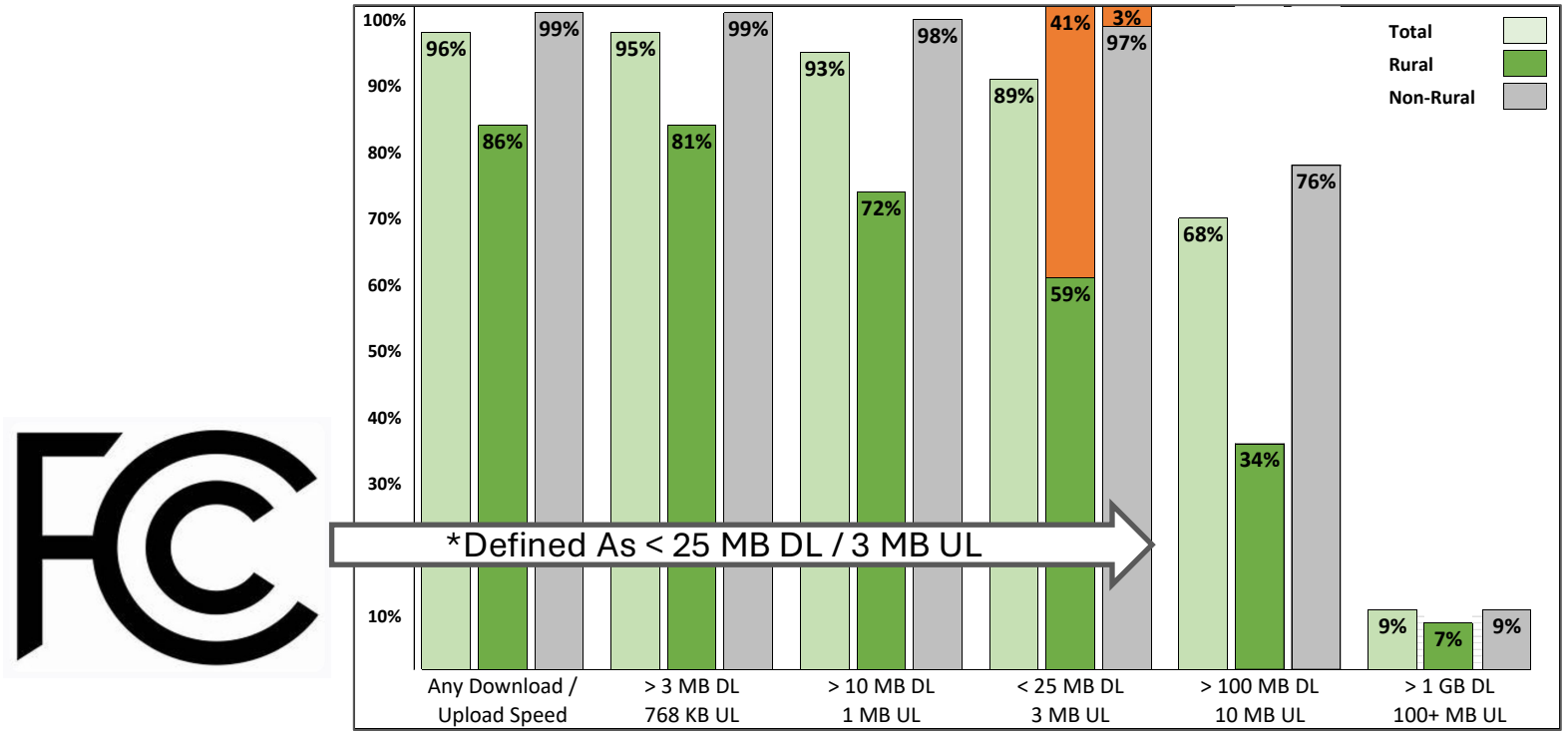
$29

A Month or Less

The Only Way to Solve It Is to Lower the Rates

Lack of Internet Access Is Mostly A Rural Problem

Taxpayers Made to Assume The Financial Burdens and Responsibility to Ensure Every Rural Family Has Reliable Internet Access



41% Rural - 3% Non-Rural

Another $42.45 Billion in Taxpayer Funded BEAD Grants Have Been Appropriated to Throw At This Problem

In Just A Few Short Years

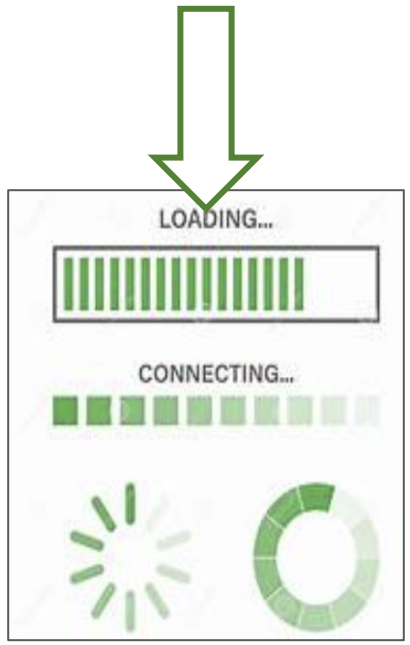
Satellite Technology Will Solve the Rural Internet Access Problem

(For Those That Can Afford It)

Slow Speed and Poor Reliability of Existing Networks
Is Not The Taxpayers or the Ratepayers Problem

Overloaded Networks and Outdated Technology
Are Commercial and Competitive Problems

If The Dominant ISP Fails to Solve This Problem

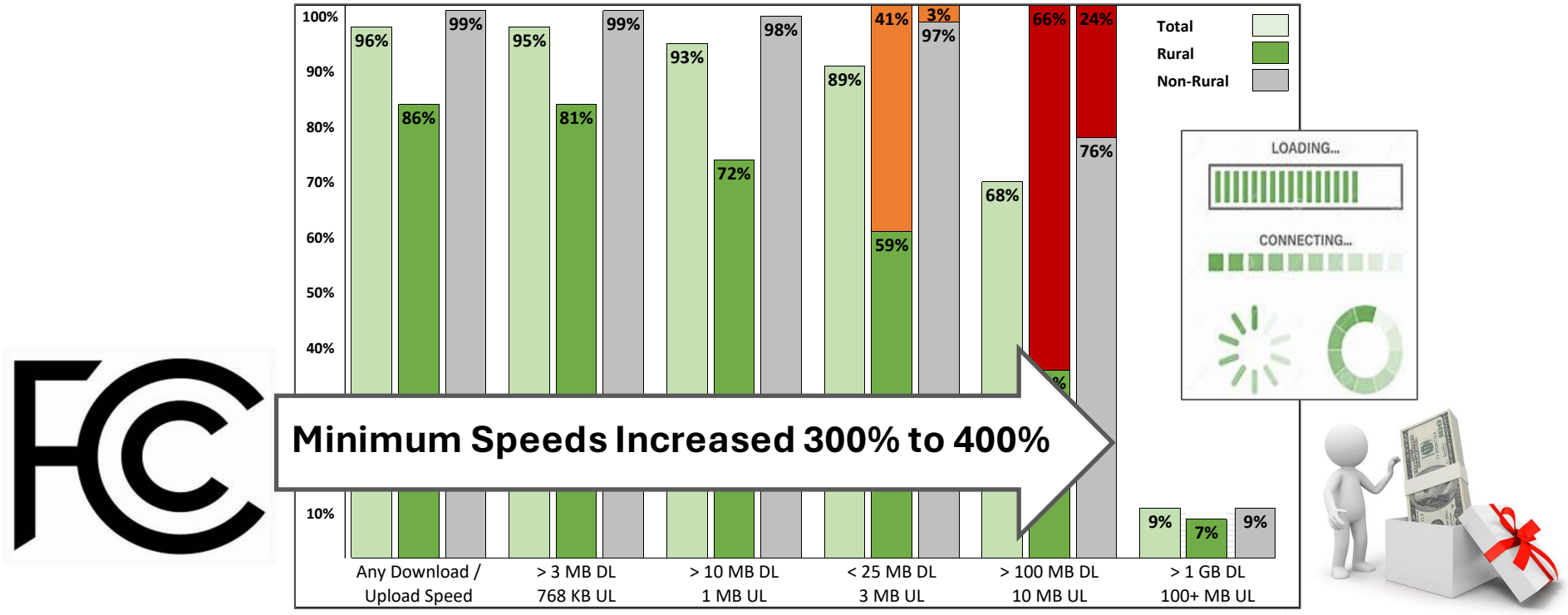


There Are Thousands More Who Will

Exactly How Capitalism Is Supposed to Work

FCC Wants to Make Speed & Reliability a Taxpayer Problem

An Artificial Crisis Concocted to Justify Taking and Gifting Hundreds of Billions In Taxpayer Funds to Bail The Service Providers Out



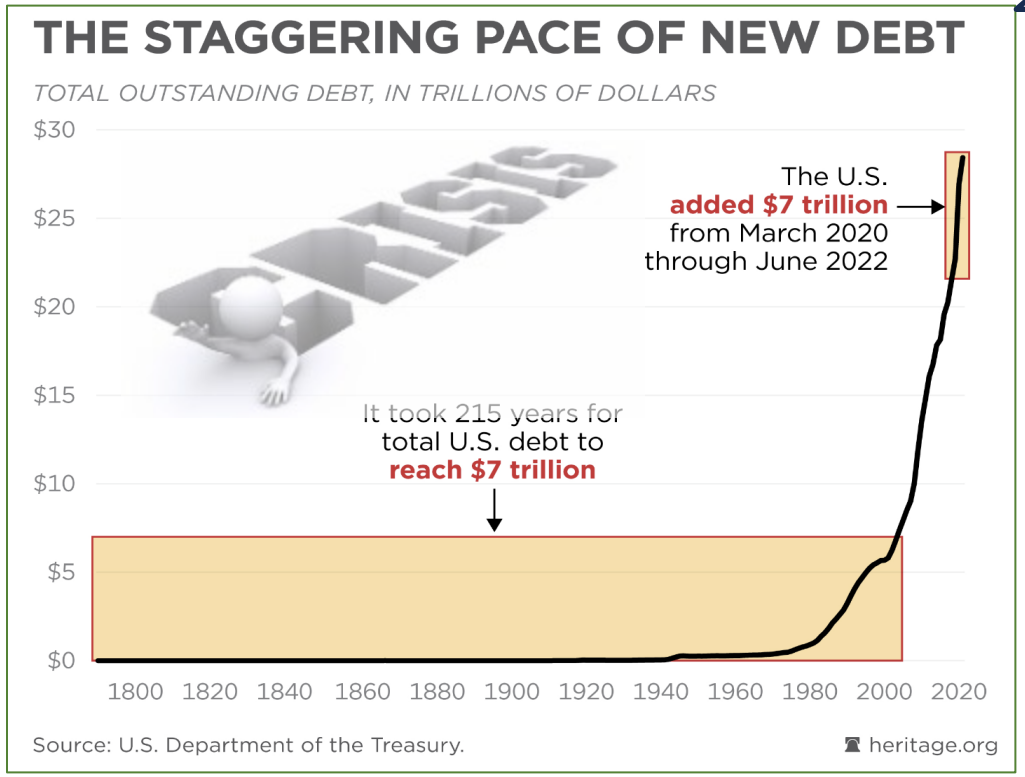
66% Rural - 24% Non-Rural

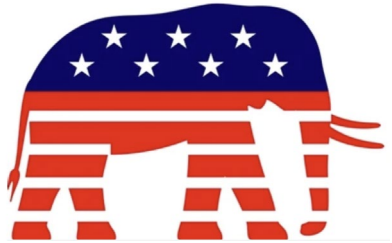
The Only Difference Between This Bailout and Those of the Banks and Auto Industries, They Paid Most of the Money Back

Every Child Born Today is $113,000 In Debt

Every Family in America Already Owes $253,000

-$34 Trillion Debt Crisis

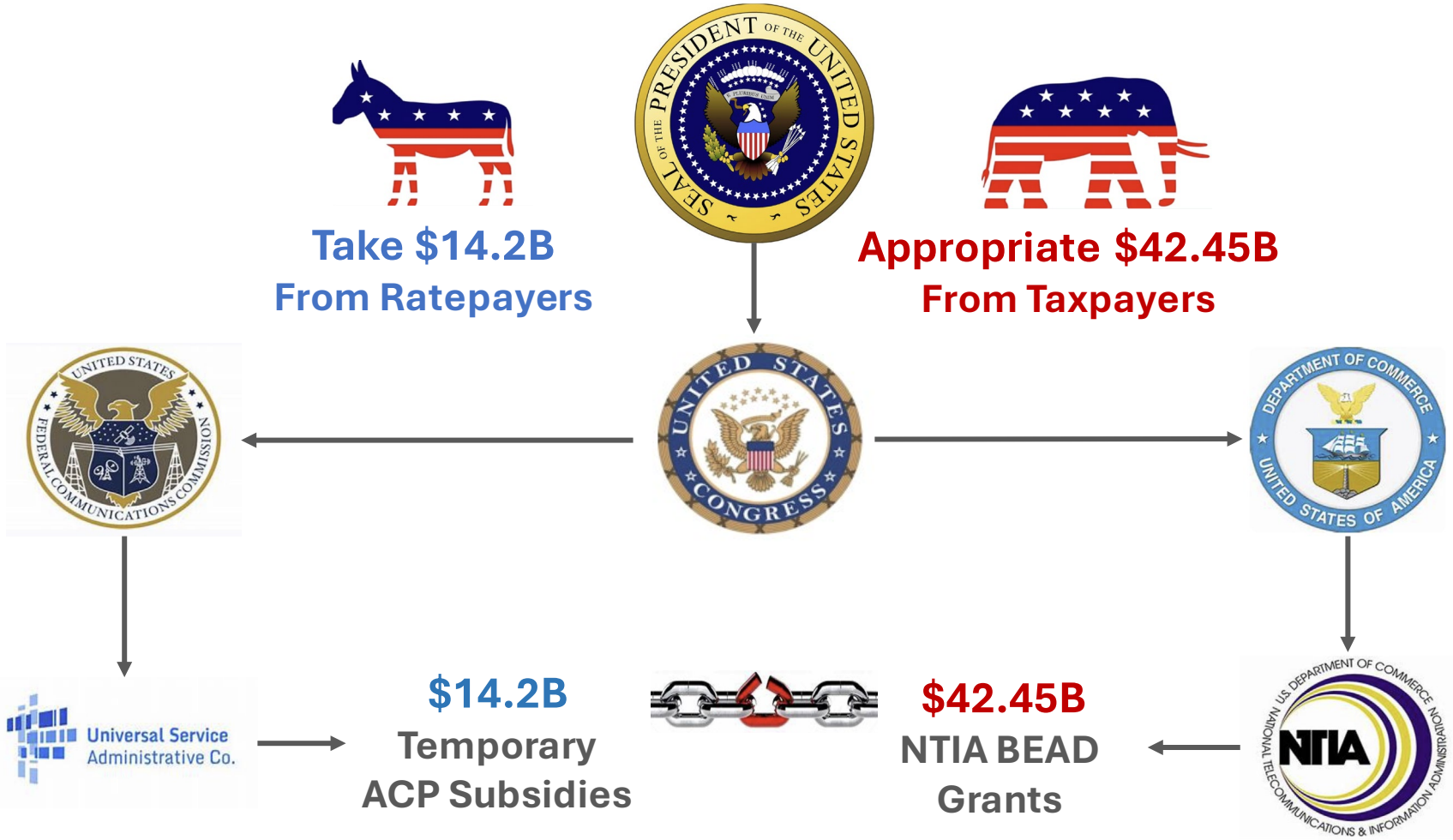




There Are Better Ways to Solve These Problems Than Robbing Our Families of Their Futures Before Their Lives Even Start

Government Has Only 2 Solutions to Every Problem

Throw Money At It Or Ignore It And Hope It Goes Away



When Neither Works, Find Someone Else to Blame

Biden Administration's "Broadband For All" Program

Promised to Bring "Affordable, High-Speed Broadband to All Americans"

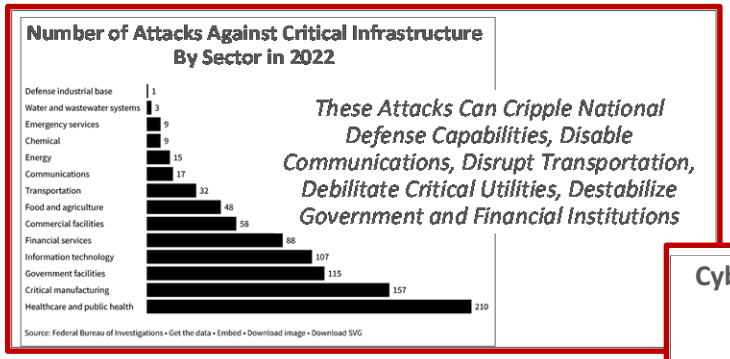
Biden Administration Appropriates $65B	Congress Passes P.L. 117-58 Eliminating Taxpayers Rights of Transparency	FCC Wastes $14.2B in Ratepayer Funds in Less Than 2.5 Years	NTIA Gearing Up to Give Away $42B to Private Companies

These and Other Grants and Subsidy Programs

Plagued By Failure, Systemic Fraud, Waste and Abuse

The Biggest Problem is the One No One Will Talk About

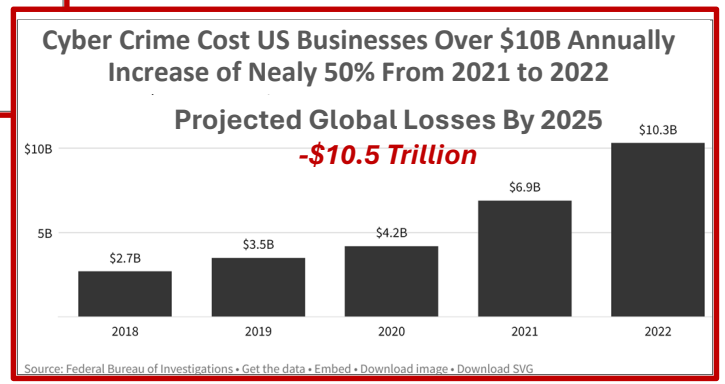
The Inexplicable Lack of Accessible Dark Fiber and the Constant Threat of Cyber Terrorism, Cyber Crime and Cyber Attack



2,200 Cyber-attack Complaints Are Reported To The FBI Every Day

Hundreds Of Thousands More Go Unreported

Open Access To Dedicated Dark Fiber Virtually Eliminates The Cyber Security Risk



Preventing Cyber Attack Is A Matter Of National Security And Defense

Anything Connected To The Public Internet Is Highly Susceptible

Https://Usafacts.Org/Articles/How-many-cyber-attacks-occur-in-the-us/

The Tragedy Is Cyber Attacks On Critical Utilities and Infrastructure Were Once Largely Preventable

Since 1994, Unregulated Service Providers Have Received ~$280B to $300B In Taxpayer Grants, Ratepayer Subsidies and Federal Tax Relief

- Unregulated and Free To Charge Whatever Rates the Market Will Bear
- No Requirement to Serve Anyone Unless They Pay For Service in Full
- Cash Broadband Subsidy Checks For As Long As Funding Lasts
- Within 90 Days of the Subsidies Running Out, Service Can Be Shut Off

No Grant, Subsidy or Form of Tax Relief Has Ever Been Conditioned on Making Fiber Capacity Available

- Not For Government, Utility or Competing Commercial Use
- No Requirements, Covenant or Condition to Pay or Give Anything Back

Now It's Just Too Late

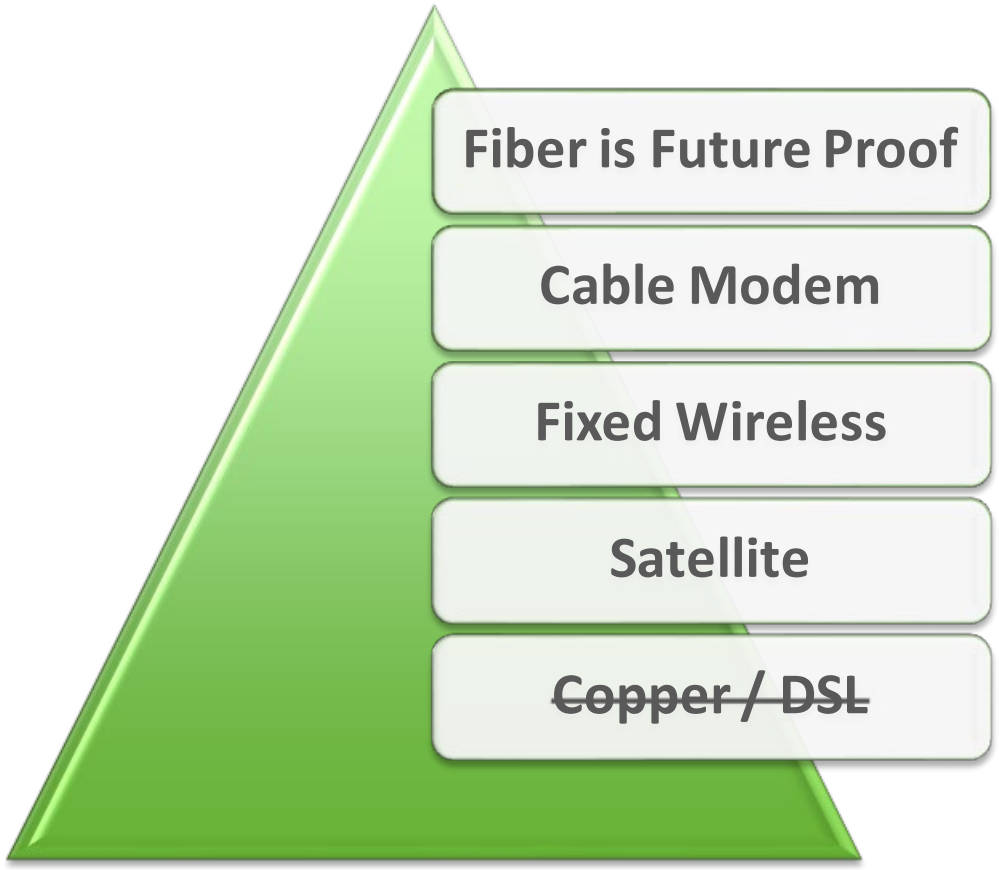
It Is Not About "How Can We Afford To Solve This Problem"?

The Question Is "How Long Will We Keep Ignoring It"?

Inevitability

Bandwidth Demand Driving Mass Migration to Fiber

Consumption of Digital Content and Data Doubles Every 2 Years



In Time, Even The Fastest Internet Service Will Be Too Slow

Everyone Will Need to Get Connected to Fiber

50,000 Communities and Public-School Districts

All Need Public Wi Fi and Affordable Broadband Over Fiber

22,000	15,000	13,000
Incorporated Cities	Rural Counties and Unincorporated Places	K-12 School Districts

Those Who Wait For an Incumbent ISP

Will End Up Waiting A Very Long Time

For Millions of Students, Seniors and Low-Income Families

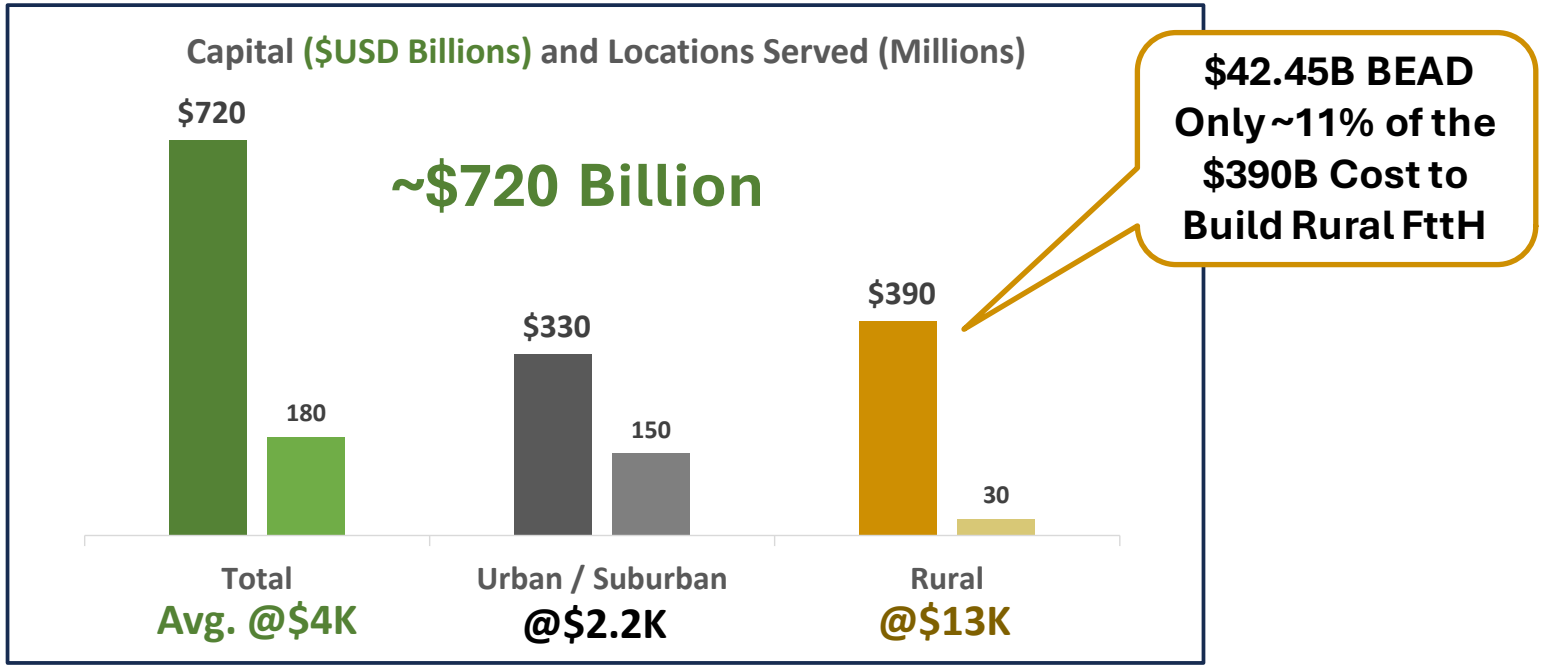
The Only Way to Connect From Home Is If The Service Is Free

Wi Fi Is Only Free in the Same Way Puppies Are Free

Someone Has to Pay for Care and Feeding

Simple Solutions to Affordable Broadband

Approximate Cost to Build Universal Fiber



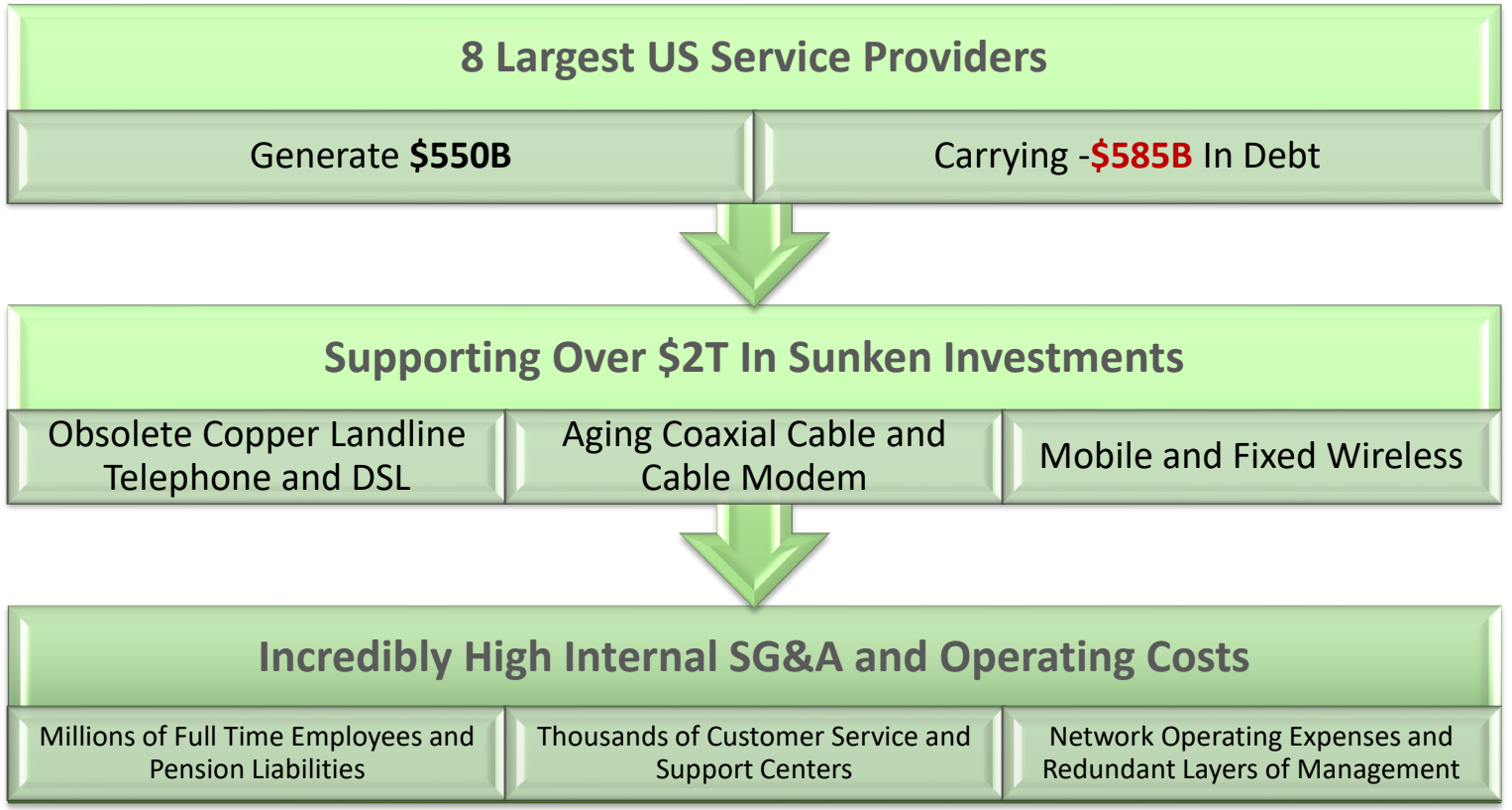
Commercial Networks Financed With Debt

$1.2 to $1.4T Loaded Capital Cost and Cost of Capital

The Telecom Industry Doesn't Have $720 Billion

Combined Debt to Revenue Ratio Close to 1.1 to 1

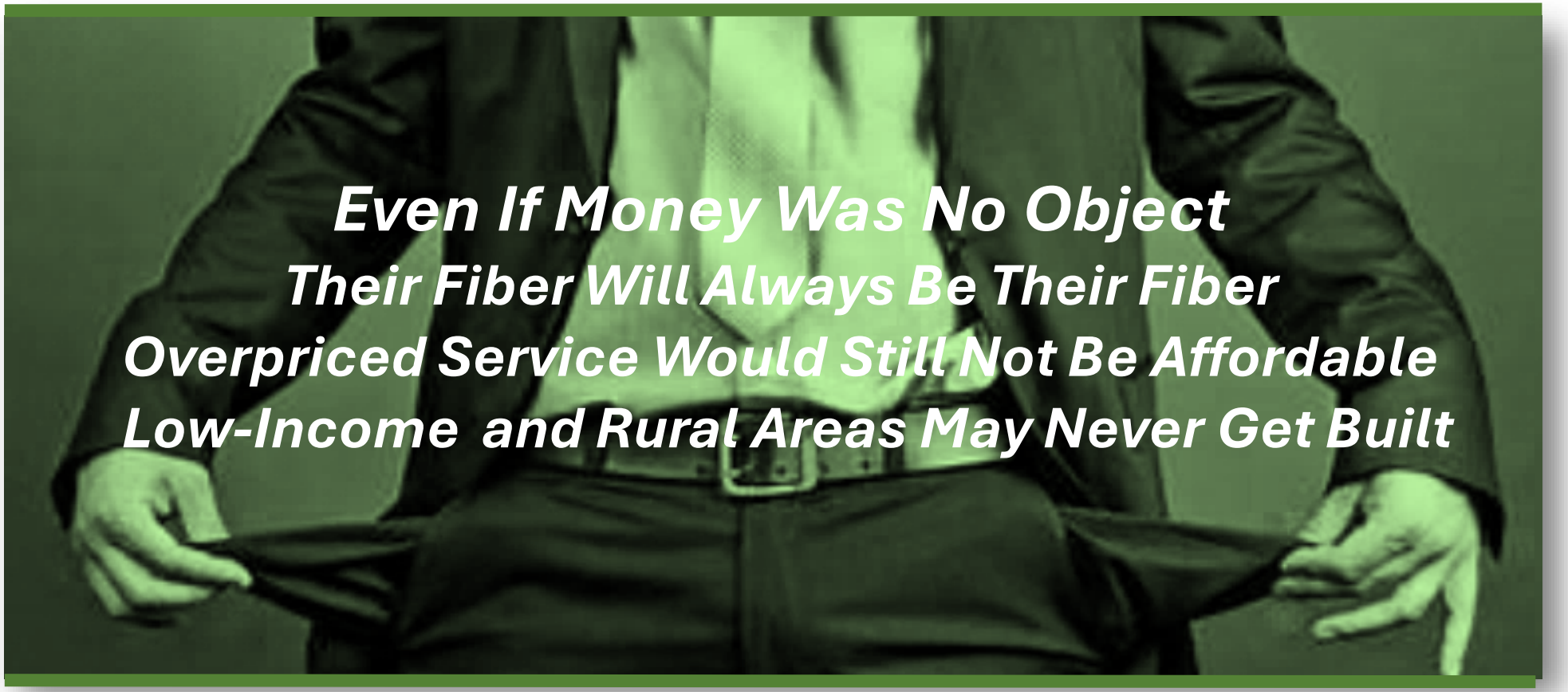
Limited to an Annual Investment of ~$20B



Low-Income and High-Cost Rural Areas Are Dead Last in Line

$720 Billion Problem and a $20 Billion A Year Budget

The Job is Too Big and Too Costly



And The Biggest Problems Remain Unsolved

Either Today or 10 Years From Now
Cities That Are Serious About Affordable Broadband Over Fiber
Treating Fiber as a Fifth Utility Is the Only Right Answer

Routing Accessible Fiber Through Every Neighborhood
Connecting Every Home, Business, Anchor Institution and School

Affordable High-Speed Broadband

Residential Rates as Low As $29 A Month

Tax Increment Financing - Millage Increase of Just ¼ of 1%
Taps Into $30 Trillion In Residential and Commercial Property Value
Invests Local Property Tax Revenues Right Back Into the Local Community

Affordability and Basic Internet Access

Are Problems That Should Not Exist

13,000
School Districts

129,000
Public Schools

2 Calif. Students Get Internet Hotspot After Viral Tweet Showed Them Using Taco Bell's Free WiFi

Published on September 3, 2020 03:29PM EDT

53 Million
K-12 Students

15 to 20 Million
Unable to Connect

3 Years and $14 Billion Later

The Pandemic May Be Over But The Problem Was Never Solved

Subsidizing A Symptom of Poverty Can Never Cure the Disease

https://people.com/human-interest/calif-students-internet-hotspot-taco-bells-wifi/

All Broadband, Wireless and Advanced Technology Needs Access to Just 4 Basic Things

Every City in America Already Has 3 Out of 4

Access to Poles and Vertical Infrastructure

- Utility Distribution Poles
- Streetlights, Traffic Signals and New Poles
- Towers, Rooftops, Water Tanks
- Public Buildings, Community Anchor Institutions, Libraries and Schools

Access to Power

- Electric Service

Access to Rights of Way (Permits)

- Expedited Zoning, Planning and Permitting

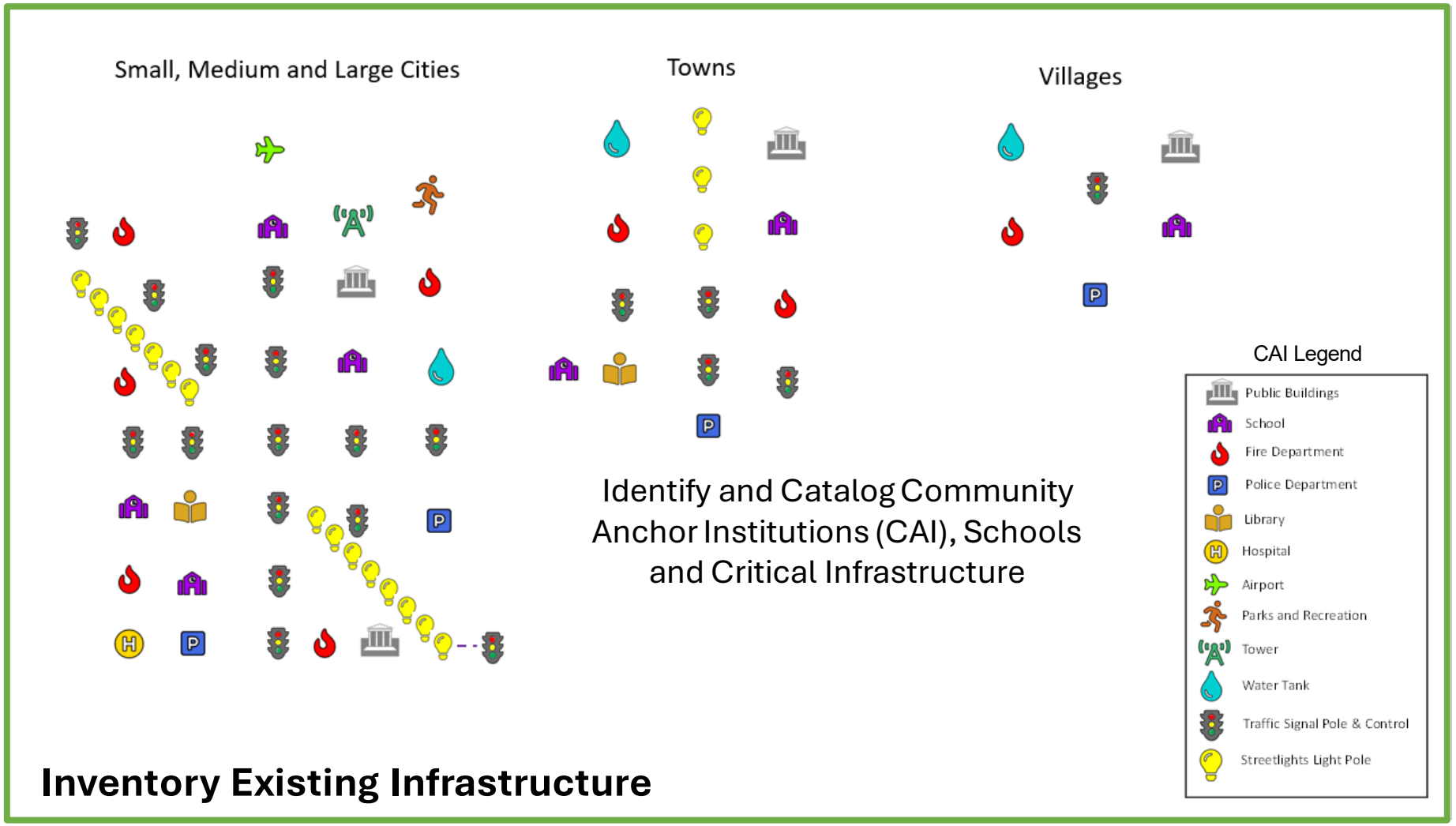
Access to Fiber

By Putting Fiber and Fiber Connected to Infrastructure To Work

Any Technology Is Deployable In Scale

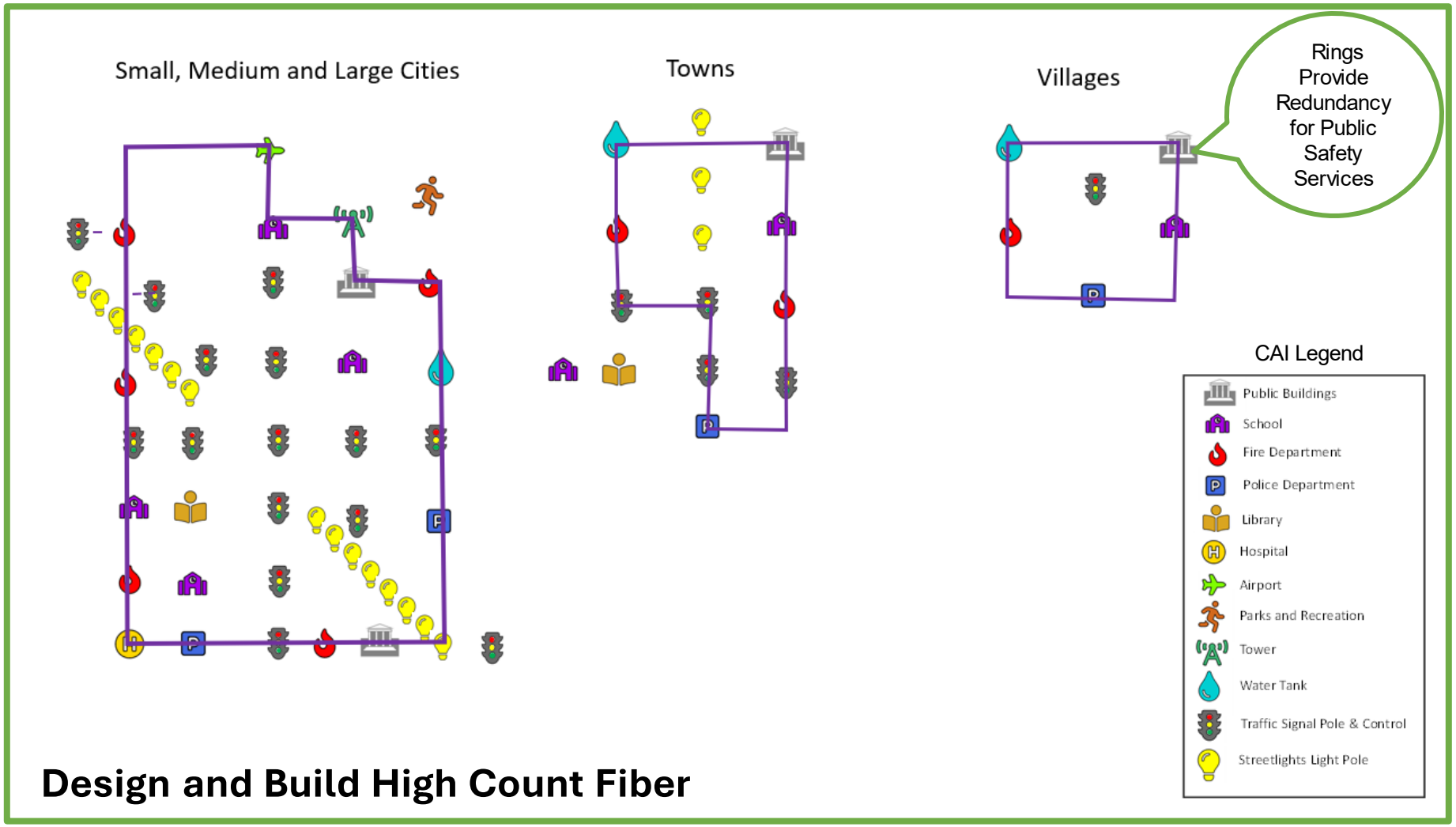
Fiber Optic Middle Mile

Hybrid Fiber and Wireless Last Mile



Fiber Optic Middle Mile

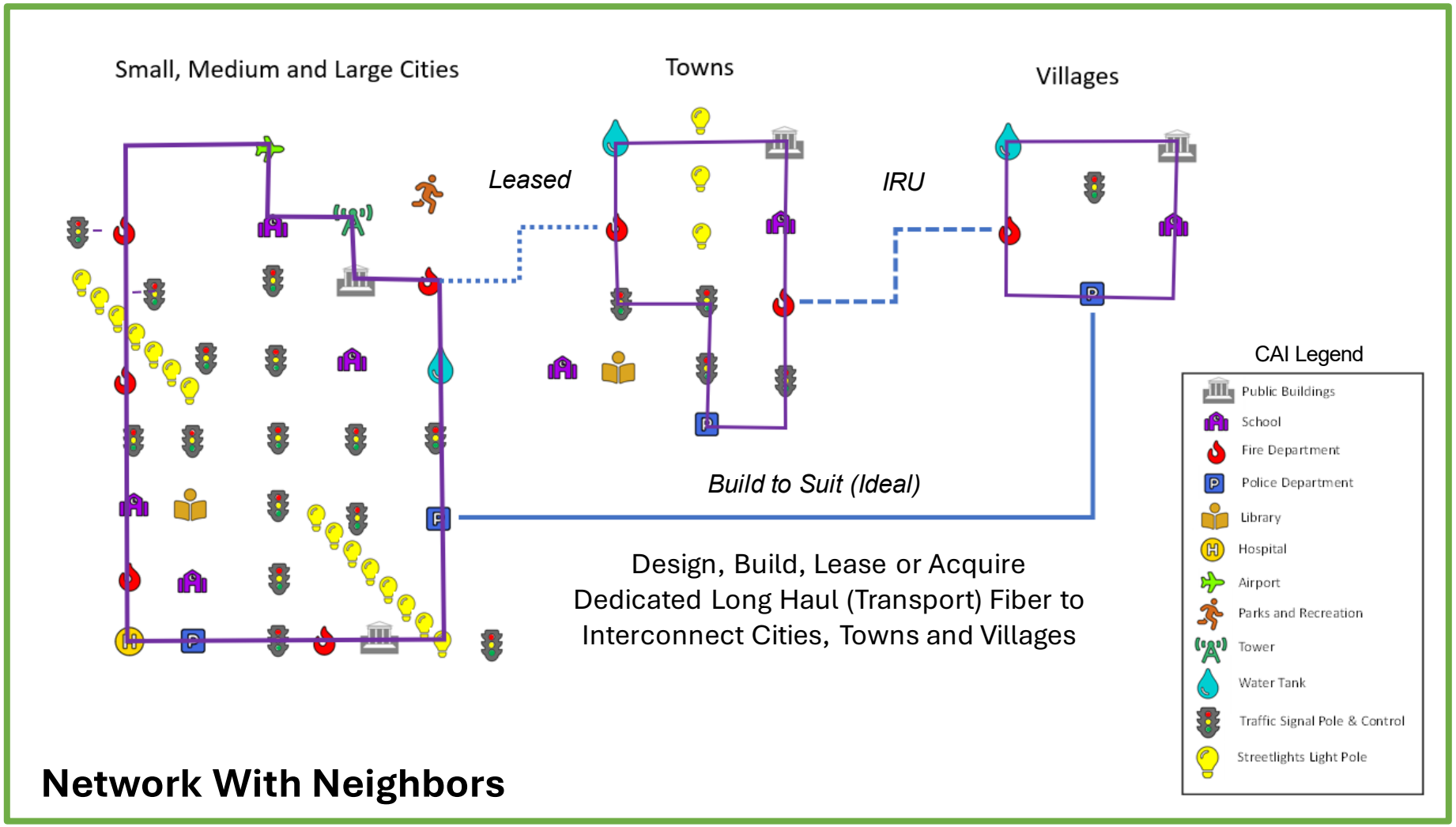
Hybrid Fiber and Wireless Last Mile



Design and Build High Count Fiber

Fiber Optic Middle Mile

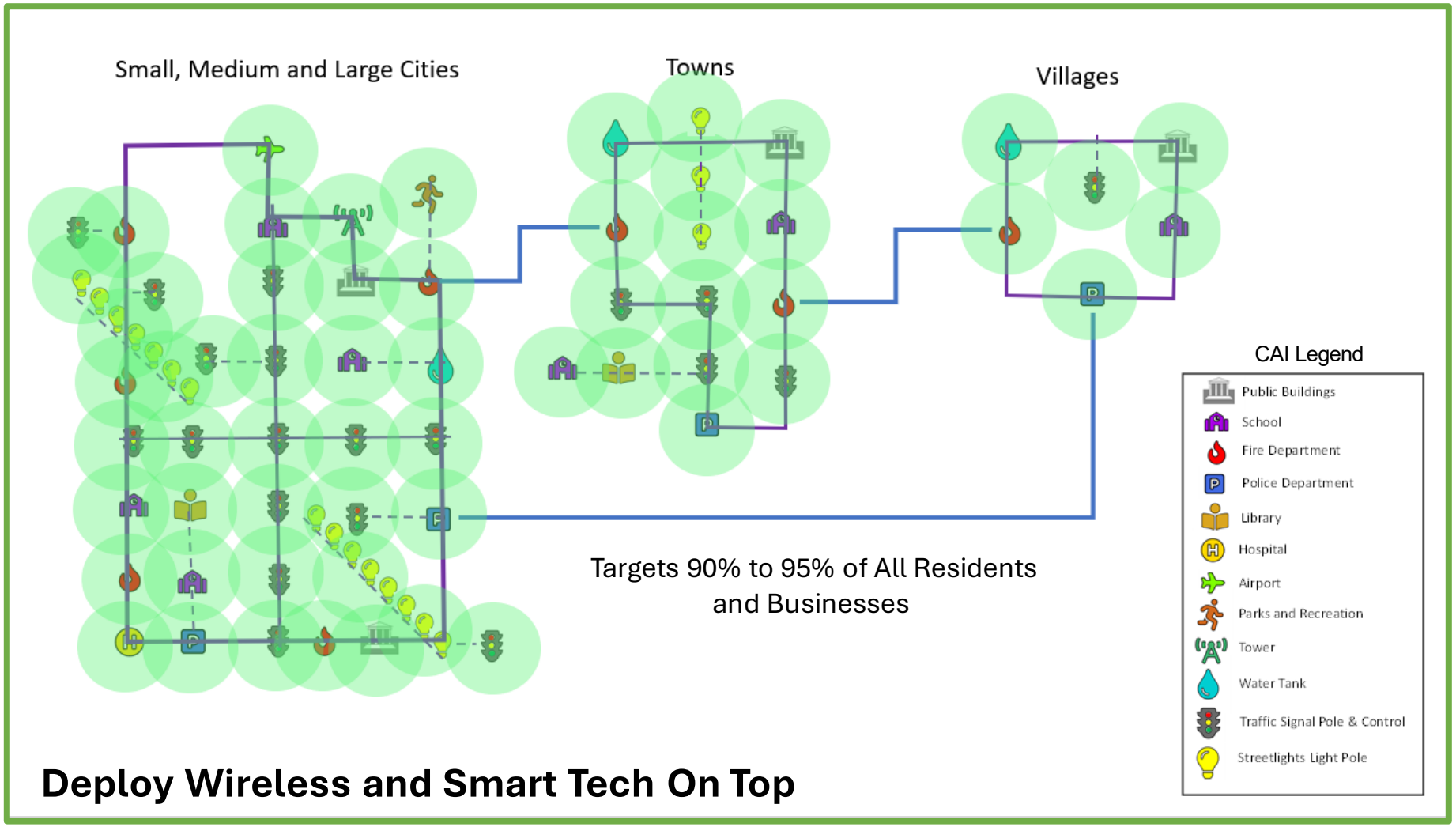
Hybrid Fiber and Wireless Last Mile



Network With Neighbors

Fiber Optic Middle Mile

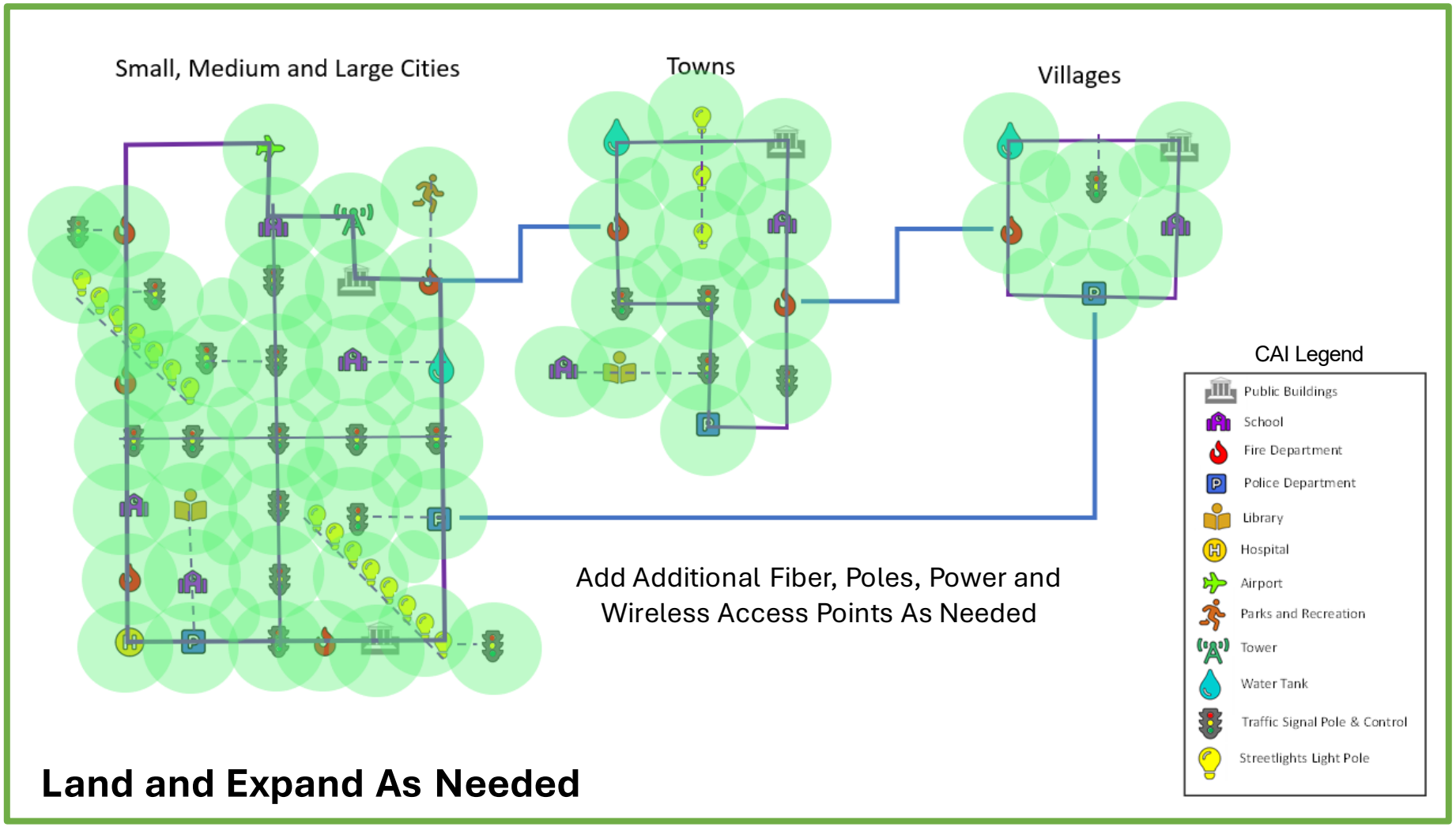
Hybrid Fiber and Wireless Last Mile



Deploy Wireless and Smart Tech On Top

Fiber Optic Middle Mile

Hybrid Fiber and Wireless Last Mile

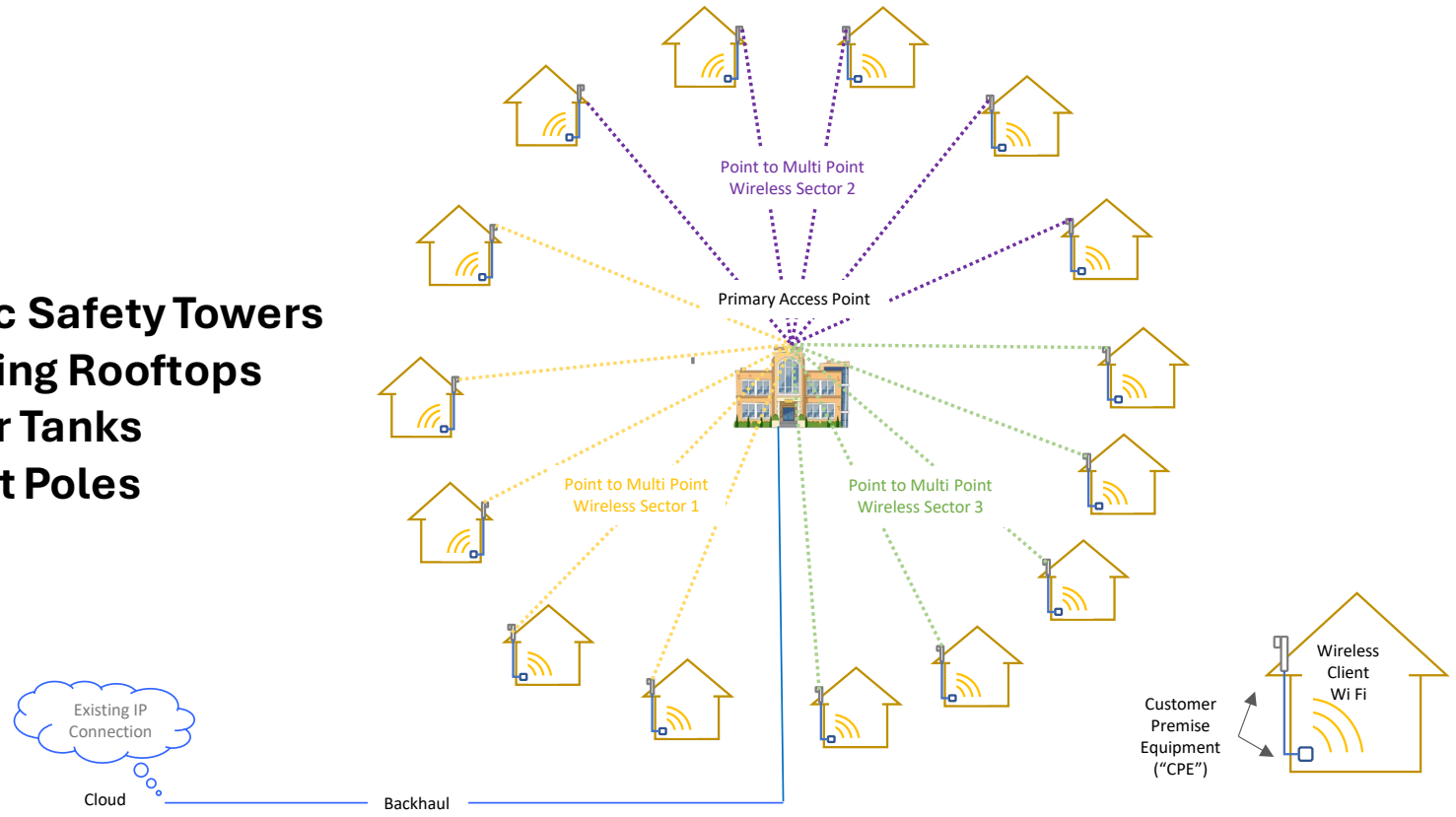


Land and Expand As Needed

Neo Neighborhood Networks™ and Connectivity For Kids™

Puts Idle Assets, Infrastructure and Technology to Work

Public Safety Towers
Building Rooftops
Water Tanks
Street Poles

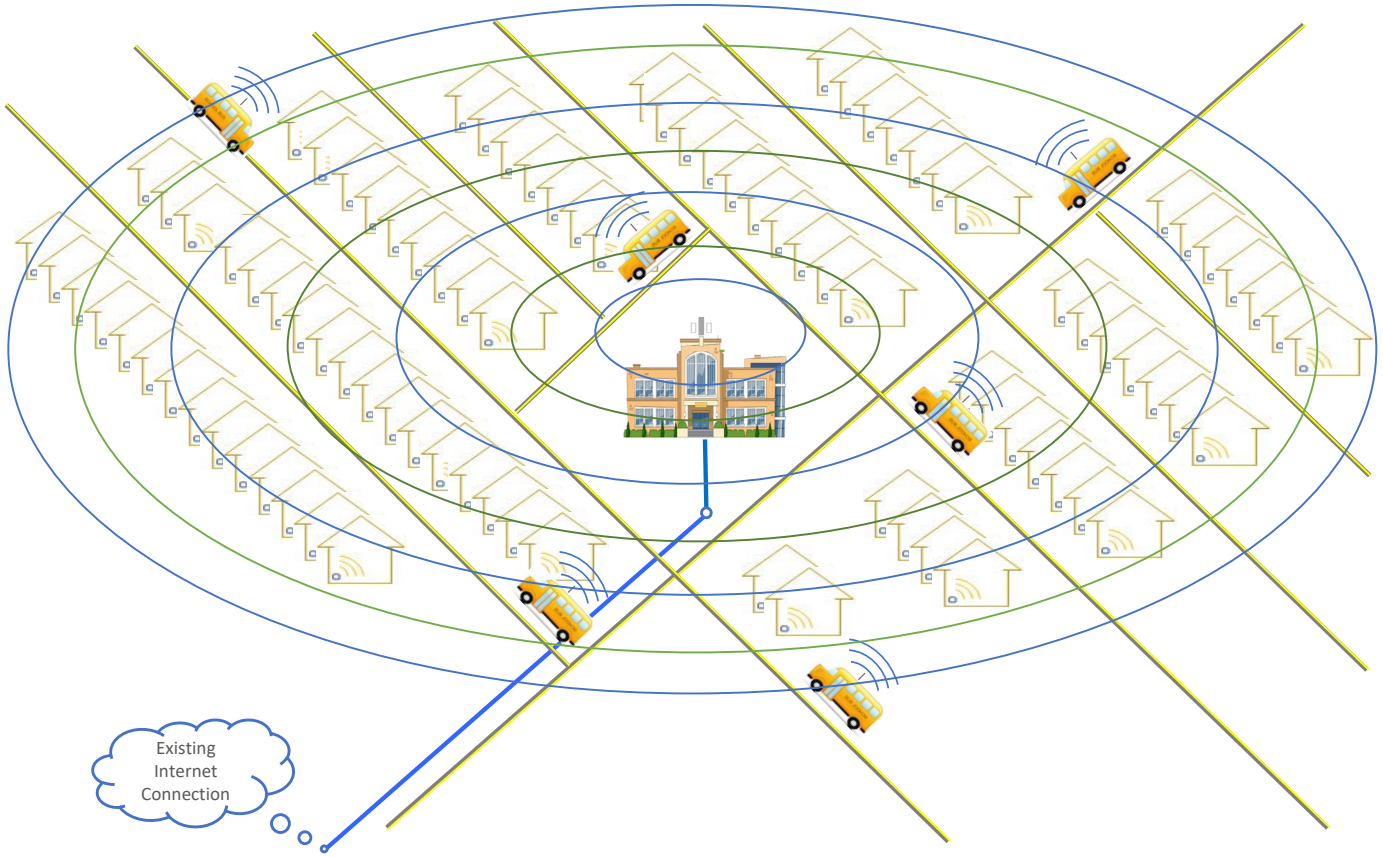


Delivering Cost-Free and Very Low-Cost Connectivity

At a Fraction of the Cost and Time of Commercial Broadband

Neo Networks Connectivity for Kids™

Connects K-12 Students to Their Schools Existing Network

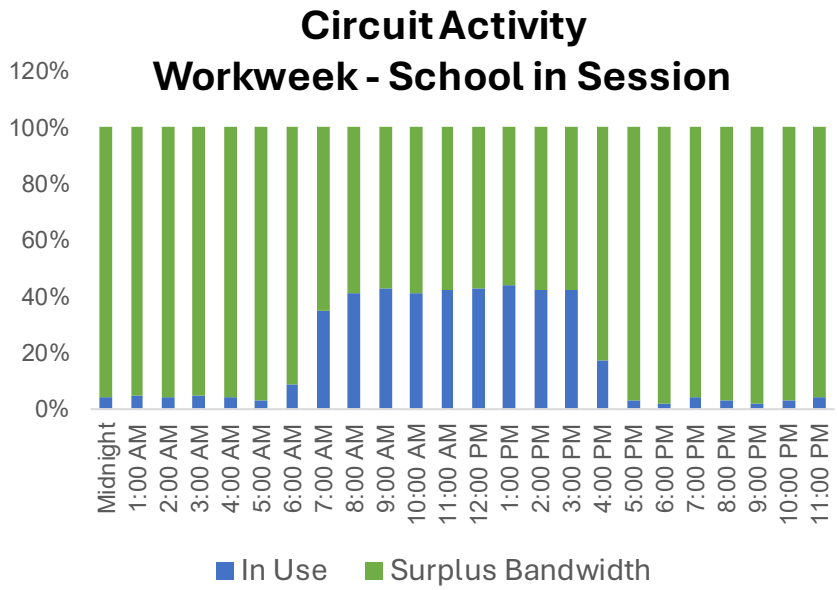


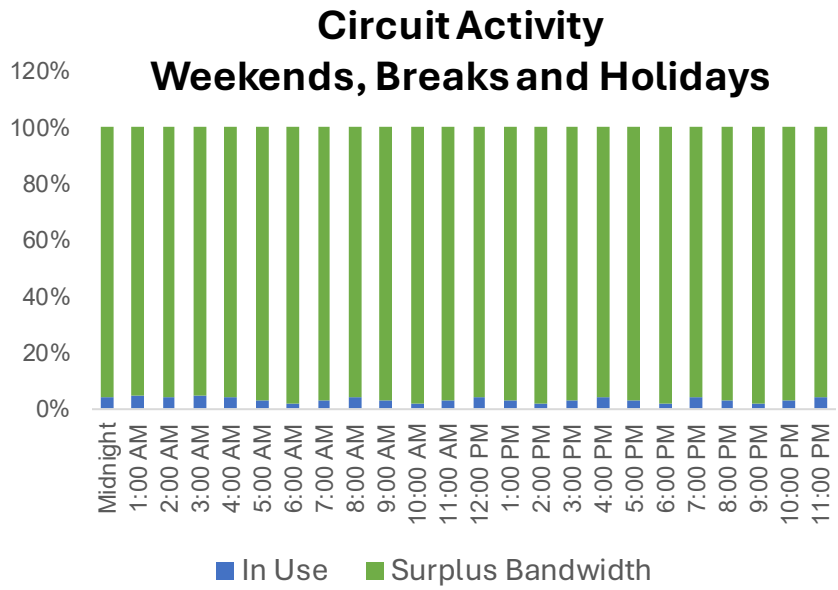
Low Cost , Power Equipment Installed on the Roof or On a Pole

Let's Kids Connect In School, On the Bus or In Their Home

Wireless Can Work Before The Fiber is In Place*

School Districts and Local Government Tend to Oversubscribe Paying for More Capacity and Bandwidth Than They Need





Using Fiber or Surplus Circuit Capacity

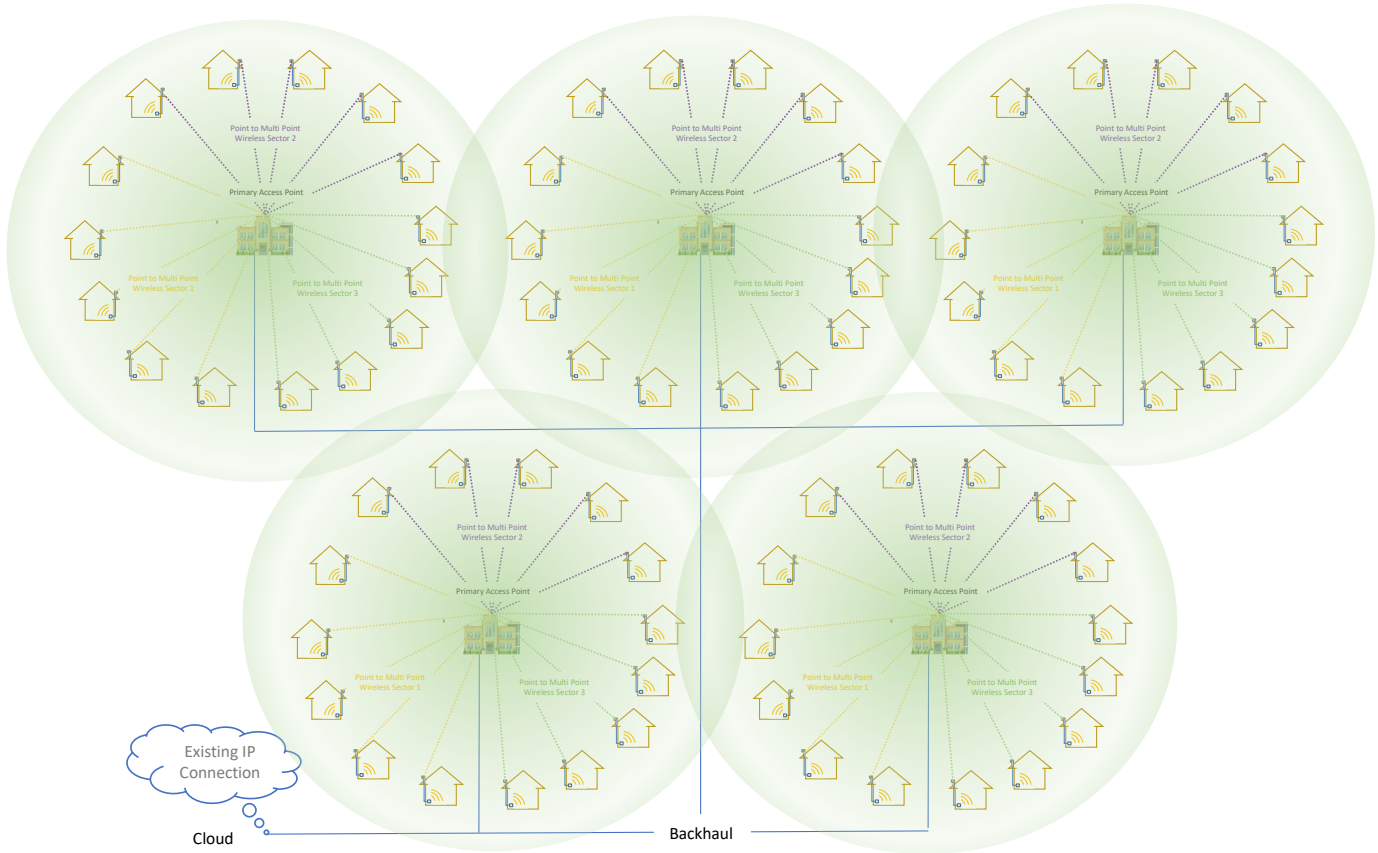
Free Public Wi Fi and Private LTE Is Plug and Play Using Existing Retail Circuits

(Michigan City Area Schools Private LTE / CBRS Case Study Available On Request)

Not Including Circuits Subsidized By E-Rate

Connectivity for Kids™ and Neighborhood Networks™

We Connect Community Anchor Institutions and Schools to Our Fiber



Deliver Best-In-Class Broadband Over Fiber

Get Public Wi Fi and Backhaul Added For Free

The Amount a City or School District Overpays For Retail

They Can Get Everything Their Community Needs

Superior Reliability, Grade of Service

- Redundant Entrances on Police, Fire, Healthcare and Emergency Services
- Three Times Faster Upload and Download Speed
- Virtually Unlimited Capacity and Bandwidth

Free and Affordable Wi Fi That Serves Every Member of the Community

- Equipment Installed On Public Property or the Rights of Way

Wi Fi Installed in School Busses

- Parental Controls and Firewalls to Curtail Access to Adult Content

Open Access Fiber Designed for Commercial and Community Use

- Competing Providers, 5G and All Advanced and Emerging Smart City Technology

Generate Non-Tax Revenue from Fiber Connected Public Infrastructure

- Sharing the Revenue Collected from Pole and Rooftop Rents

Changing Einsteins Definition of Insanity

Doing the Same Thing Over and Over Again But Getting A Completely Different Result

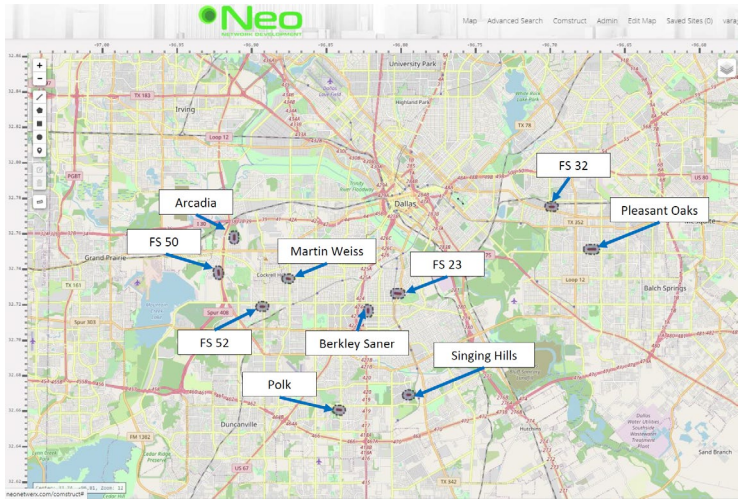
Case Studies and Hybrid Designs

Neo Neighborhood Networks™ - Dallas Digital Pilot

City of Dallas, Texas

In June of 2021, Neo Networks was invited to bid on a Request for Developer Interest ("RDI") issued by the City of Dallas, Texas. Neo competed against dozens of respondents including AT&T (*headquartered in Dallas*) , Comcast and UPN that were each providing fiber and / or broadband services to the City of Dallas and the Dallas Independent School District.

In October of 2021, Neo subsequently competed for and was awarded a series of wireless pilot networks in 10 underserved, low-income Dallas neighborhoods. The City had also elected to self-perform the development of 10 additional networks led by its CIO and IT Staff.



By late December of 2021 Neo Networks deployed all 10 networks consisting of 10 host sites (*4 City Fire Departments and 6 Recreation Centers*), 72 new solar powered, green energy powered poles and a total of 82 wireless access points, antenna systems and an integrated network monitoring and billing system.

Ultimately, the City spent over $3.2 million to deploy their wireless networks covering just 150 homes over a period of more than 6 months at an average capital cost per home of over $21,000 *(~5 times more than fiber to the home*).

In contrast, for just $2 million, Neo was able to cover over 3,200 homes at an average cost of just $625 per home and within 30 days, the newly deployed networks were providing cost-free service to 1,600 residents.

Neo Networks demonstrated the ability to deploy superior networks 4 times faster, cover 24 times as many homes at an average cost per home that was 34 times more capital efficient per home than the networks deployed by the City itself.

Since the completion of the pilot projects in December of 2021 and launch in January of 2022, having reviewed the comparative results of the pilot projects, the City has been reevaluating its broadband plan and internal ability to execute.

Neo Networks Open Access™ and Neighborhood Networks™

Self-Sustaining, Infinitely Scalable and Repeatable

In 2021, Neo Networks lobbying efforts in Washington DC helped secure congressional approval to establish NTIA's $1 billion Middle Mile Grant("MMG") program. Throughout 2022, Neo Networks partnered with LaPorte County, Indiana, Natchitoches Louisiana, Muskegon Heights and Roseville, Michigan to produce the designs, budgets, revenue models, justification of need and the volumes of collateral, materials and letters of support from elected officials and community leaders needed to qualify and apply for the NTIA MMG Grants and on September 30, 2022, all four applications were submitted to NTIA.

The **LaPorte County Indiana** application consists of 272 route miles of high count, build to suit Open Access fiber optic network needed to interconnect 21 unserved and underserved townships in agricultural areas throughout rural LaPorte County and a gigabit fiber to the home solution for over 6,800 homes within 250' and over 17,000 within 1000' of the middle mile fiber.

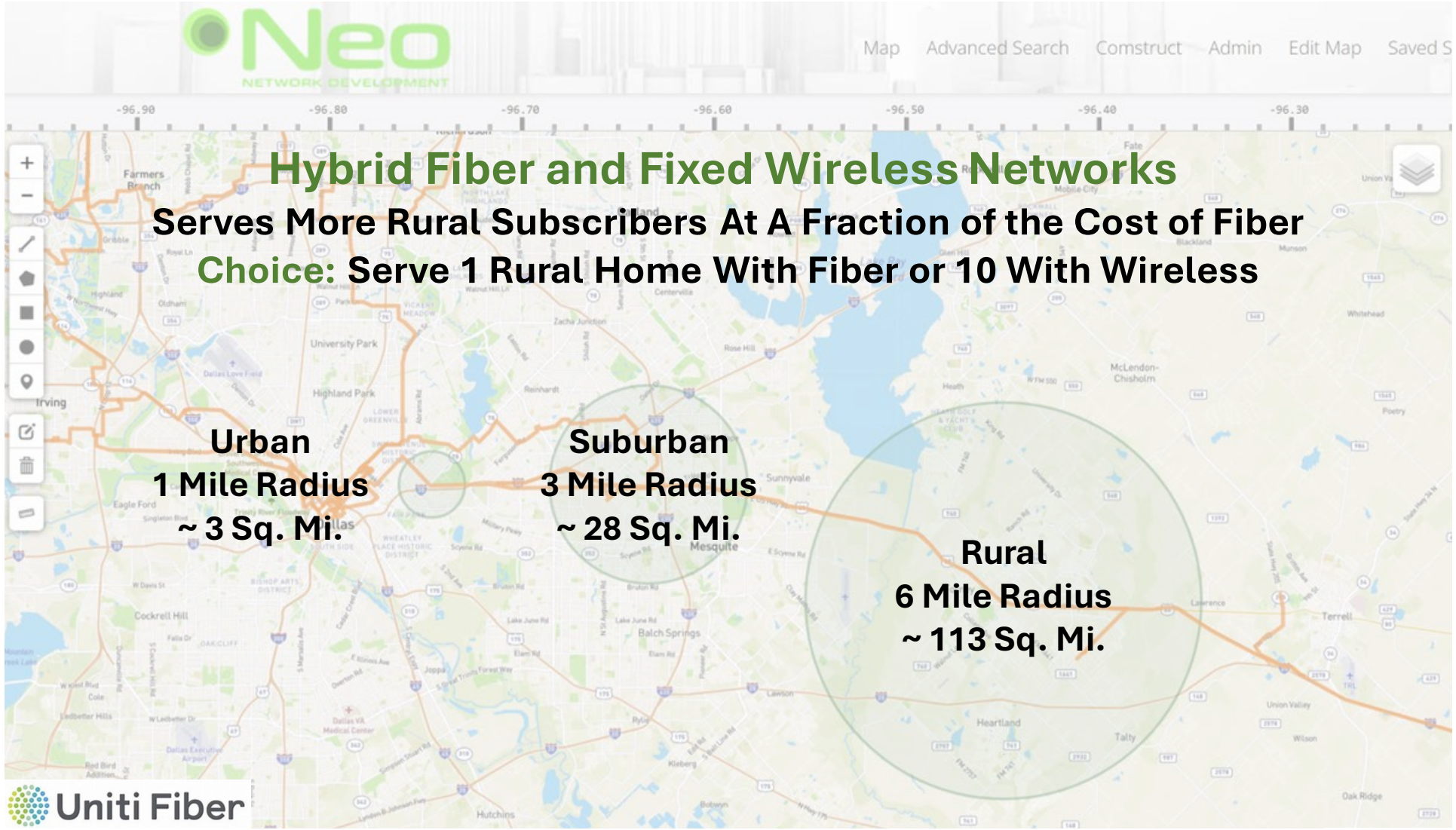
The **Natchitoches, Louisiana, Muskegon Heights and Roseville, Michigan** networks were each designed as hybrid fiber optic middle mile and wireless last mile networks that include build to suit, Open Access fiber, placement of new, multi-carrier capable poles on public property and rights of way with wireless last mile networks to provide cost free public wi-fi and affordable, fixed wireless broadband and mobile data services targeting 95%, 97% and 98% of all homes and businesses respectively.

These hybrid networks were designed specifically to support the first phases of fiber to the home and an affordable wireless broadband alternative to commercial internet services that 30% to 45% of their residents are unable to afford representing the most capital efficient solution for communities whose residents may never be able to afford commercial broadband or gigabit fiber to the home.

If approved by NTIA, NeoNetwerx will engineer, permit, build, operate, monitor, maintain and repair the networks and provide all internet services including marketing, sales, order fulfillment, back-office and billing functions and actively market and lease the fiber and fiber connected infrastructure for commercial use to create additional non-tax revenues on behalf of the local community.

Each of these communities have committed to contribute Capital, In-Kind Value and pay the first 5 years of operating expenses totaling $5.4 million in order to qualify for their MMG Grants make gigabit fiber to the home service available at unsubsidized price points below $60 per month (*~1/2 of current retail rates*) and wireless service upgrades available for unsubsidized price points ranging from $15 to $30 per month inclusive of mandatory fees and taxes. Families that qualify for and receive the $30 per month Affordable Connectivity Program ("ACP") subsidy will then be able to get a reliable, in-home wireless broadband connection at no cost or a gigabit fiber connection for just $30 per month.

As annual revenues exceed the operating expenses, the asset base and the net revenues will be collateralized to secure additional capital to finance the ongoing expansion of fiber to the home.

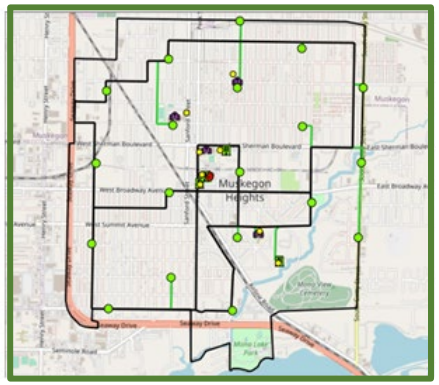
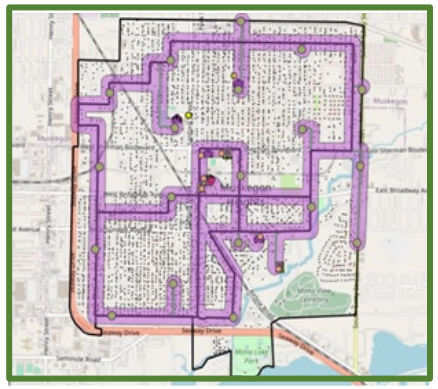
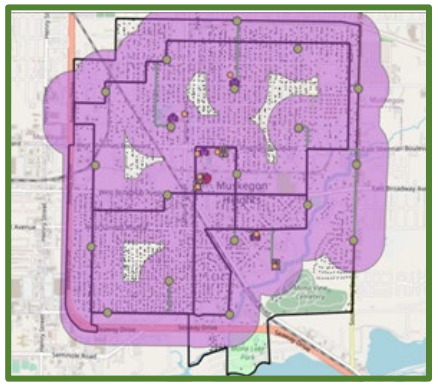
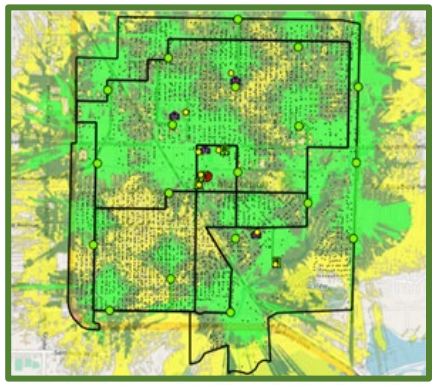


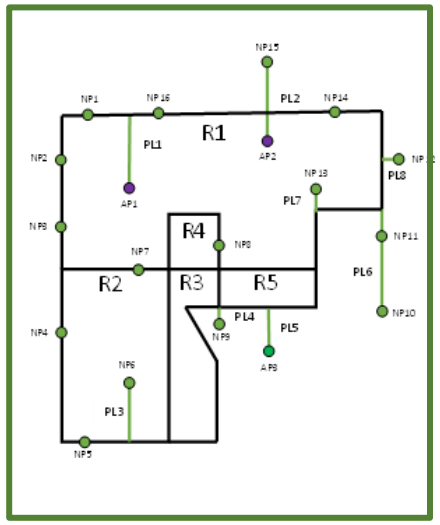
Wireless Works For Precision Agriculture and IoT

$$A = \pi r^2$$

Neo Neighborhood Networks™ Design

Muskegon Heights, Michigan



Total Cap/Ex:
- ~$4.24 MM

Fiber Per Location :
- $2,826

Wireless Per Location:
- ~$925

Op / Ex Increase:
- $0

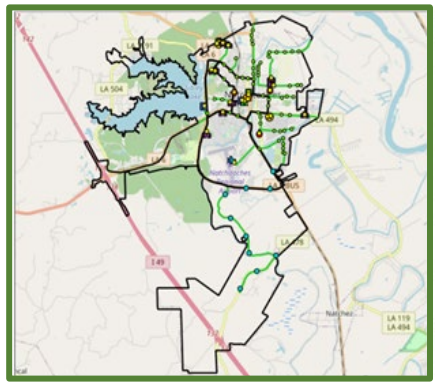
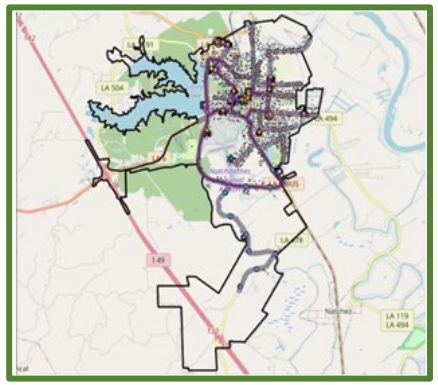
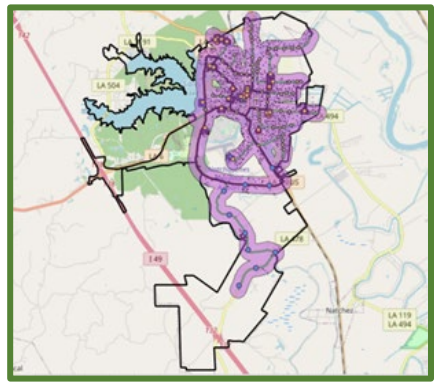
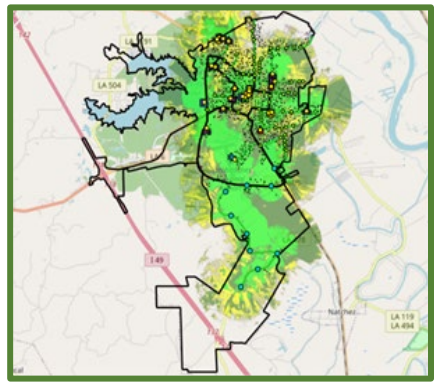
Route Miles of Fiber
- 14.3

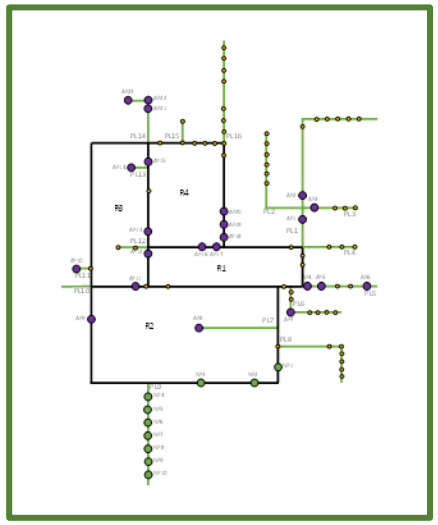
Homes & Businesses Passed
- 1,508 Within 250’ (~31.9%)
- 4,263 Within 1000’ (~90.1%)

Wireless Coverage
- 9,652 Pops (~97%)
- 4,587 Homes and Businesses

Neo Neighborhood Networks™ Design

Natchitoches, Louisiana



Total Cap/Ex:
- ~$10.46 MM

Fiber Cap/Ex Per:
- $4,900

Wireless Cap/Ex Per:
- ~$600

Op / Ex Increase:
- $0

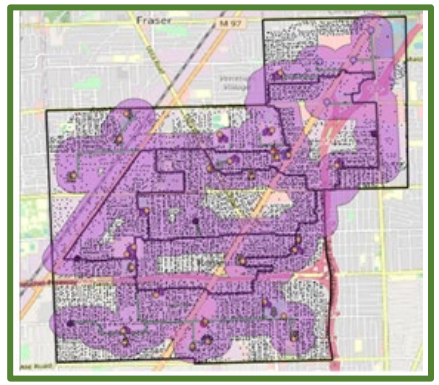
Route Miles of Fiber
- 34.7

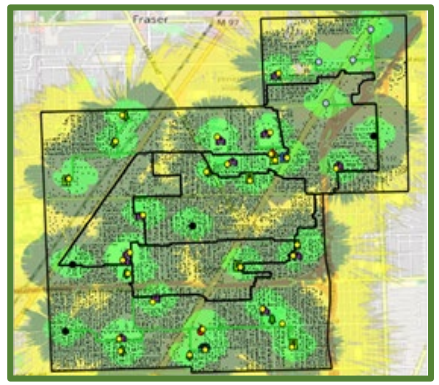
Homes and Businesses Passed
- 2,132 Within 250’ (~28.8%)
- 6,716 Within 1000’ (~90.7%)

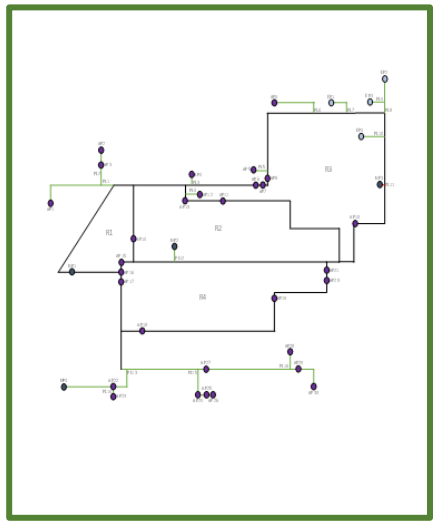
Wireless Coverage
- 17,407 Pops (~95%)
- 7,033 Homes and Businesses

Neo Neighborhood Networks™ Design

Roseville, Michigan







Total Cap/Ex:
- ~$9.1 MM

Fiber Cap/Ex Per:
- $1,815

Wireless Cap/Ex Per:
- ~$394

Op / Ex Increase:
- $0

Route Miles of Fiber
- 24.4

Homes and Businesses Passed
- 5.012 Within 250’ (~21.3%)
- 16,999 Within 1000’ (~72.2%)

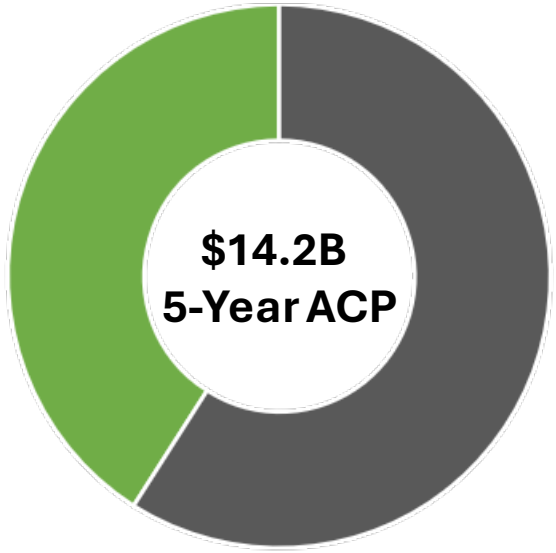
Wireless Coverage
- 46,353 Pops (~98%)
- 23,080 Homes and Businesses

Post Mortem of ACP

Affordable Connectivity Program ("ACP") Was Only Funded to Support 7.8 Million* Households for 5-Years

Of the 128 Million US Households

53 Million (41%)
Eligible For ACP



75 Million (59%)
Ineligible Ratepayers

ACP Was Never Intended to Lower Rates

*$1,800 X 7.8 Million = $14.04B

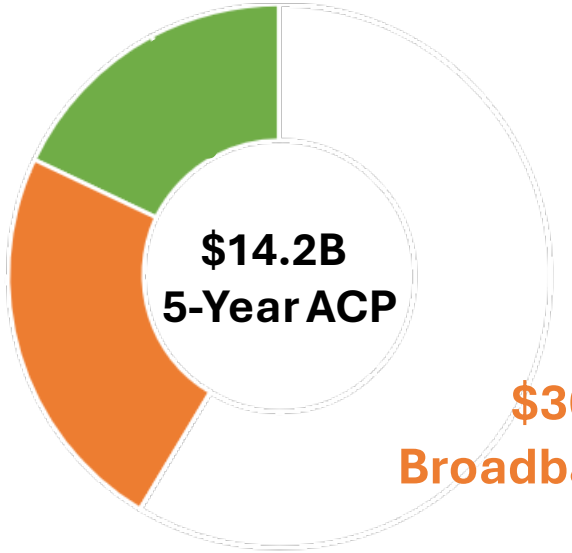
Cost to Support All 53 Million Households for 5 Years

$95.4 Billion – Underfunded By 670%

Of the 53 Million Eligible for Benefits

23 Million
Enrolled

30 Million
Did Not Apply



$30 Off Fails to Make Broadband Affordable Enough

The Lowest Income Households and Families That Needed the Help The Most Did Not Apply

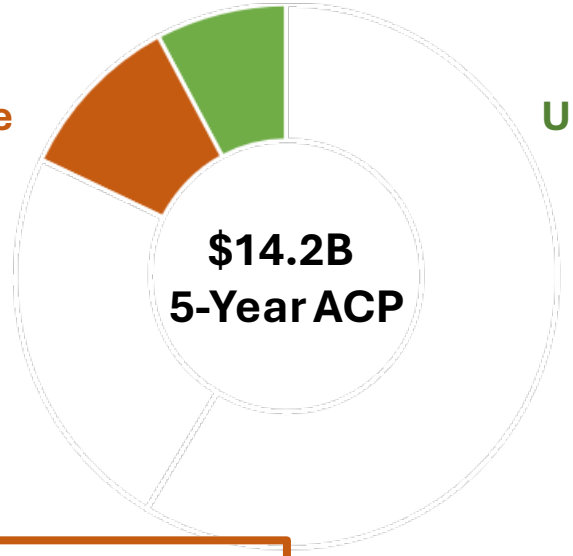
Cost to Support 23 Million Households for 5 Years

$41.4 Billion – Oversubscribed and Underfunded By 290%

Of the 23 Million Enrolled in ACP

13 Million (10%)
Allowed to Abuse ACP to Pay One Family Members Cell Phone Bill

10 Million (8%)
Used ACP Household Benefits for In-Home Broadband



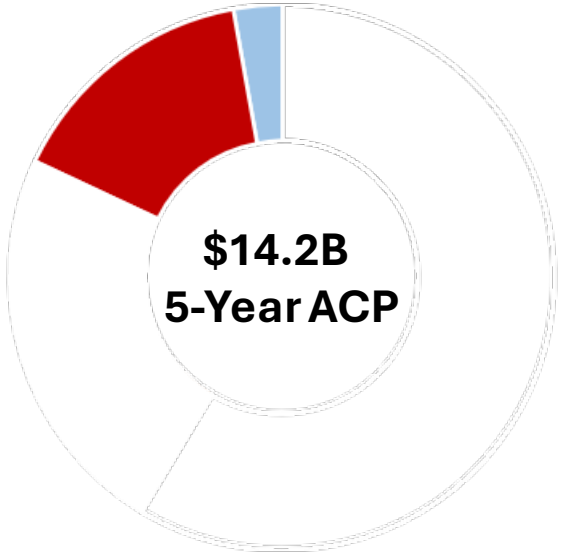
$23.4B
Abuse

$18B
Intended Use

Nearly $12B In Abuse of ACP Funds in 2.5 Years

Of the 23 Million Enrolled
84% Already Had Internet Service

19.3 Million
Enrolled But Didn't Really Need It



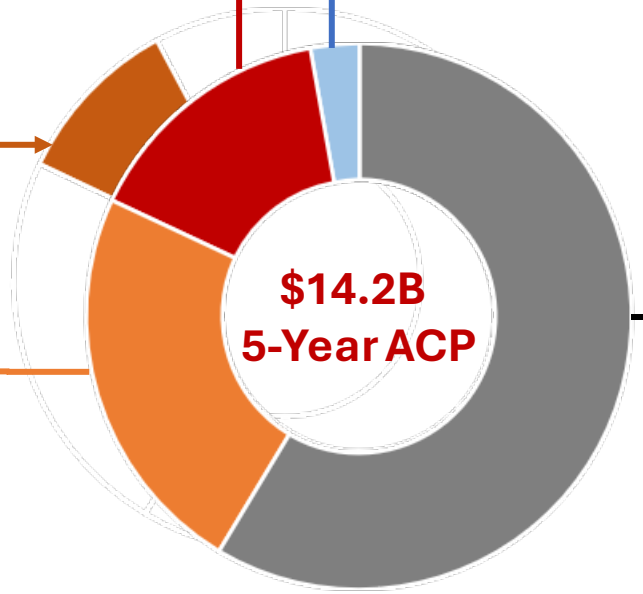
3.7 Million
Enrolled Because They Needed It

ACP Efficacy *(By the Numbers)*
We Only Hear About the 23 Million Enrolled

19.3 Million (15%)
Took It But Didn't Need It

13 Million
Abused It

30 Million (23%)
Didn't Apply
Since It Didn't Help

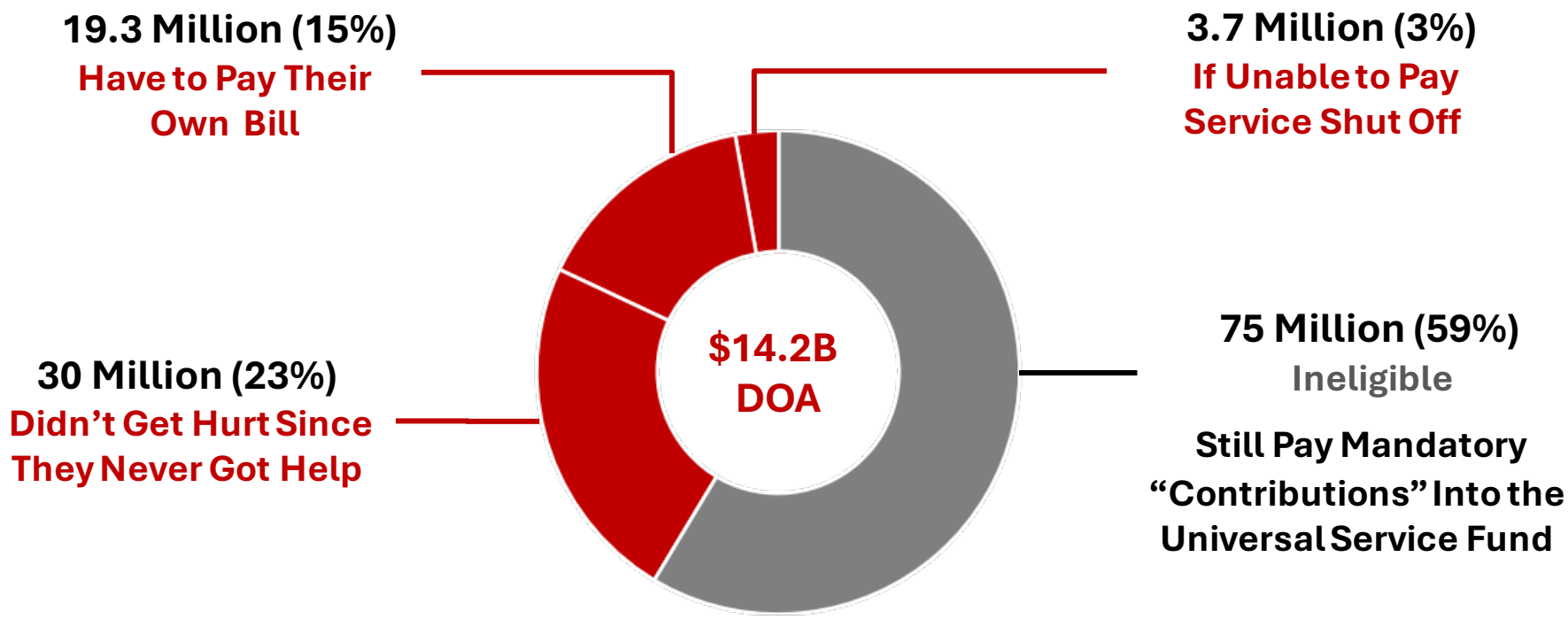


3.7 Million (3%)
Needed It and Lost It

75 Million (59%)
Ineligible
But Forced to Pay For It

Not the 19.3 Million That Took It But Didn't Need It, the
13 Million The FCC Allowed to Abuse Their Household Benefit
or the 30 Million That Couldn't Be Helped

The FCC Spent $Millions$ Promoting an Underfunded Program
Funds Ran Out in Half The Time



Despite The Public Failure of ACP
The FCC Is Asking Congress For More

Mismanagement, Waste and Abuse Put an Early End to ACP

Incl. $75 Subsidy for Native American Tribes

The FCC, USAC & the Universal Service Fund Now In the 5th Circuit
Funding for K-12 Connectivity, Seniors and Rural Healthcare Also At Risk

Universal Service Fund programs

The E-Rate Program: This program helps tens of thousands of schools and libraries buy connectivity services and equipment.

The High Cost Program: This program, which counts various projects among its efforts including the Rural Digital Opportunity Fund, helps subsidize broadband deployment and operating costs for telecom companies seeking to serve customers in rural parts of the United States.

The Lifeline Program: This subsidy, which dates to the Reagan era and has evolved over the decades, aids several million low-income households with a monthly benefit of $9.25 for phone or internet services.

The Rural Health Care Program: These subsidies flow to help subsidize the costs of internet connectivity for eligible healthcare providers like hospitals and community health centers, with the goal of benefiting consumers in remote parts of the country.

White House Asks for Money to Continue High-Speed Internet Discounts

Number of households that rely on Affordable Connectivity Program approaches 22 million

Unless Congress funnels additional money toward the nearly two-year-old Affordable Connectivity Program (ACP) that helps make high-speed internet access available to almost 22 million low-income households, its resources will run out by the beginning of May, according to an analysis of federal data from Common Sense Media, a nonprofit best known for rating entertainment on its age appropriateness for children.

The White House is asking Congress for $6 billion to continue the program through December 2024.

Congressional Research Service
Informing the legislative debate since 1914

Legal Sidebar

Fifth Circuit Considers Constitutionality of the Universal Service Fund

A court might kill the Universal Service Fund. Even some Republicans fear the outcome.

Conclusion: ACP Was Designed and Timed to Fail During an Election Year
$14.2 Billion in Ratepayer Funds Unlawfully Spent to Buy Votes

https://www.politico.com/news/2023/08/21/universal-service-fund-broadband-00110255
https://crsreports.congress.gov/product/pdf/LSB/LSB10904
https://www.aarp.org/home-family/personal-technology/info-2021/fcc-subsidy-helps-broadband-internet-access.html

ACP and BEAD Alternatives

The End of ACP and the Predictable Impact on BEAD Grants

$42.45B Earmarked for Unserved Rural Areas

$250M Already Spent Setting Up State Broadband Offices (“SBO”)

- Sole Purpose is to Give Away $42B of the Taxpayers Money

$3 Billion Allocated for Native American Tribes (Est. 300 NAT’s @ $10M Each)

- All Tribe Members Eligible for $75 a Month ACP Benefit

Rural Areas are Extraordinarily High-Cost Places to Build Fiber

- NTIA Policy Authorizes Up to $13K Per Unserved Location Passed
- $20K Total Including the Service Providers 30% Capital Contribution (~$4K Each)

Up to $80K to $100K Actual Cost Per Rural Location Served With Fiber

- Based on a Realistic 20% to 25% Rural Take Rate

Up to $65K in Taxpayer Funds Spent Per Rural Location Served

- Over $100K Including Interest And Inflationary Effect Of Printing Cash

Result: Up to 60% of Rural Residents Are Unable to Afford Fiber to the Home

- Doesn’t Help The Farmers That Need Wireless for Precision Agriculture

The Anticipated Result of NTIA BEAD Grants

*Assuming BEAD Survives

Most of BEAD Will Be Awarded to Wireless Service Providers*

- Service Providers That Collect Mandatory "Contributions"
- Download and Upload Speeds Fail to Meet FCC Minimum Requirements

Commercial ISPs Will Not Apply

- Focus Investment in Moderate to High Income Suburban and Urban Areas
- Avoid Low-Income Neighborhoods and Rural Areas
- No Rational Business Case for Rural Fiber to the Home

300 Native American Tribes Will Endure Financial Hardships

- Over-relying on $75 a Month ACP Subsidies to Cover Operating Costs

Hundreds of Reluctant Co-op and REU's Forced to Reconsider

- Most Had No Interest Getting Into the Broadband Business
- Pressured into Becoming Internet Service Providers
- Grants Limited to Unserved Locations
- Unable to Offer Universal Service
- Loss of ACP Benefits Decrease Take Rates (Revenue Loss)

Protracted Timetables

Block and Tackle and Force to Load Problems

Average Deployment Timelines Trending Toward 5+ Years

- State Broadband Plans
- Distribution of Digital Fabric Data
- Grant Application Prep., Review, Approval and Protest Periods
- Service Provider Capital Contributions

Limited Utility and Municipal Resources and Support

- Slow Planning and Permitting Reviews and Approvals
- Make Ready Engineering and Construction Work Delays
- Right of Way Access, Pole Attachments and Easements

Buy American Mandates Exacerbate Serious Logistics Challenges

- Global Supply Chain Shortages
- Fiber Cable, Hardware and Materials Not Made in America Requiring Waivers

Human Capital

- Chronically Open Positions for Qualified Engineering and Skilled Trades
- Lack of Brains, Bodies and Bucket Trucks

The $14.2 Billion The FCC Wasted on ACP

Was Enough to Connect Millions of Students and Their Families

$10.3B – Enough to Deploy Low-Power Public Wi Fi or Private LTE Equipment and New 60' Poles on All 129,000 School Properties (~$80K Each)

- 516,000 Sectors (4 Sectors Per School)

$4B – Enough to Place 2 to 4 Million WI Fi Access Points ($1K to $2K Each)

- Enough to Connect 40 to 60 Million Low-Income Households

Local Government and School Districts Would Incur Virtually No Cost

- No Site Rent or Measurable Increase in Electric Service Cost
- No Increase In Retail Internet Bandwidth Cost

K-12 Students and Their Families In Range (1.5 to 3 Mile Radius)

- Able to Connect Through The Schools Existing Network

Cost to Upgrade Service As Low as $5 a Month

- Eliminating Rate Caps and Parental Controls

A Small Amount of Revenue Ensures Self-Sustainability

Covering Expenses and Equipment Replacement Cost at End of Life

Investing Rather Than Spending $42.45 Billion in BEAD Grants

Publicly Funded Fiber Pays The Taxpayers Back

$40B – Enough to Deploy Over 400,000 Miles of High-Count Fiber

- $100K Per Mile Average

Enough to Connect Over 400,000 Anchor Institutions and Schools Within 1 Mile Each Other (~80%)

- ~$100K Budget Per Location

Taxpayers Pay Over $10.5 Billion a Year For Individual Retail Circuits

- At and 80% Connection Rate, Fiber Would Save Over $6 Billion a Year
- 7 Year Return on a $40B Investment From Savings Alone

Billions More Generated from Open Access / Commercial Use

- Enough Non-Tax Revenue to Cover All Fiber Related Expenses
- The Non-Tax Revenue Surplus Pays for Free Public Wi Fi

Public Funds Invested in Publicly Owned Fiber

- Complies with the US Constitution and Federal Law

Programs to Supplement Telecom Costs For Government, Healthcare, Community Anchor Institutions and Schools

Hard Wired for Retail

Mandatory Ratepayer "Contributions" Into the Universal Service Fund Administered Via the Universal Service Administrative Company (USAC)

- Funding for E-Rate, Lifeline, ACP and Other Subsidies
- Paid for By Landline Telephone, Long-Distance, Mobile and VoIP Subscribers (Ratepayers)
- Demand For Traditional Services Diminishing, Funding Is Falling Off

Broadband Internet Subscribers, Big Tech, Content Providers and E-Commerce are Exempt From USF

- New Policy and Regulations To Augment Declining Funds From New Sources (Time Will Tell)
- Mock Battles Between Political Adversaries, Regulators and Special Interest Groups Wage On

Reliance Federal Funds Controls Public Agencies

Consumers, Subscribers, Ratepayers & Taxpayers Will Keep Paying The Price For Generations to Come

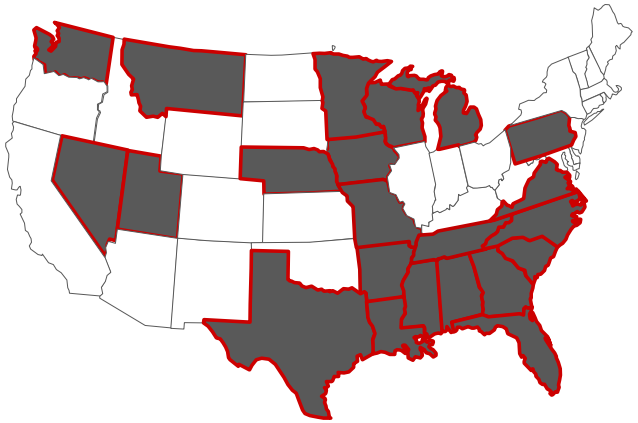
Anti-Competitive State Laws

Want Local Government and School Districts to Pay Retail

State Law in 19 States

Restrict or Prohibit Local Government From Building Community Broadband Networks That Compete With Private Companies

Burgeoning Digital Society



Stuck in a Retail Economy

In The Other 31 States

Succumbing to Political and Lobbying Pressures, Lack of Budget, Commercial Experience, Internal Subject Matter Expertise and Resources

Due to Elevated Risk and Sheer Level of Effort

Only A Few Will Even Consider Attempting It On Their Own

USF and E-Rate Funds Offered to Help Schools and Students

Restrictions On Use Prevents Permanent Solutions

E-Rate Funds Provide Capital to Pay For Fiber

- Intended to Improve Service and Save Taxpayers Money
- Complicated Eligibility Criteria and Application Process
- Use is Limited to K-12 Students and Faculty Only

Excludes Wireless Equipment and Prohibits Home Wi Fi Use of Schools Network and Private LTE to Deliver Wi Fi onto School Busses

- Use is Restricted to School Property and Grounds Only
- 5th Circuit Court Case Based on Off Campus Use (Covid 19) Sect. 224 of T.C.A

School Districts Prohibited From Using Fiber to Serve Local Community Members in Need or to Generate Non-Tax Revenue

- Prohibit Use for Any Commercial Purpose that Competes With Retail Providers

As a Disincentive to Doing the Right Thing and Saving Money

Their Budgets Get Cut

Permanent Solutions Are Prohibited By Law

National Broadband Policy, Anti-Competitive and Conflicting Federal and State Laws, FCC Orders, Taxpayer Funded Grants and Funding For E-Rate, Lifeline and Subsidies for Low-Income Families Would No Longer Be Necessary

Seniors and Low-Income Families Would No Longer Need to Rely On Entitlements or Government Support

Government May Be Broken But The Business Model Works

(Even Without Their "Help")

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President/CEO

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(630) 590-9390 x101 (714) 271-2356 mobile

Wireless Global Congress Americas

Betty Cockrell

Single Digits

OpenRoaming™: Simplifying Citizen Access in Wi-Fi Connected Communities

OpenRoaming: Simplifying Citizen Access In Wi-fi Connected Communities

OPENROAMING™
WIRELESS BROADBAND ALLIANCE

Challenges for Cities Deploying Wi-Fi

- Delivering secure connectivity
  - Ensuring users are connected securely
- Adhering to privacy requirements
  - Depending on the region - privacy rules vary and can complicate implementations
- Providing simple and seamless connections for users
  - “Cellular like connections”
- Simplifying access for visitors
  - Ability to connect visitors securely and simply

OpenRoaming™

Wireless Broadband Alliance

Why Deploy OpenRoaming?

- OpenRoaming is a roaming federation which enables an automatic and secure Wi-Fi experience using Passpoint Technology
- The WBA created the OpenRoaming framework to connect billions of users and things to millions of Wi-Fi networks globally - **standards based**
- The WBA maintains a robust library of documentation and case studies providing information on how to deploy OpenRoaming www.openroaming.org
- OpenRoaming is maintained by the WBA OpenRoaming Standards Group providing a mechanism to deliver enhancements and new features and address any problems
- Adoption world-wide by some of the leading companies in Wi-Fi

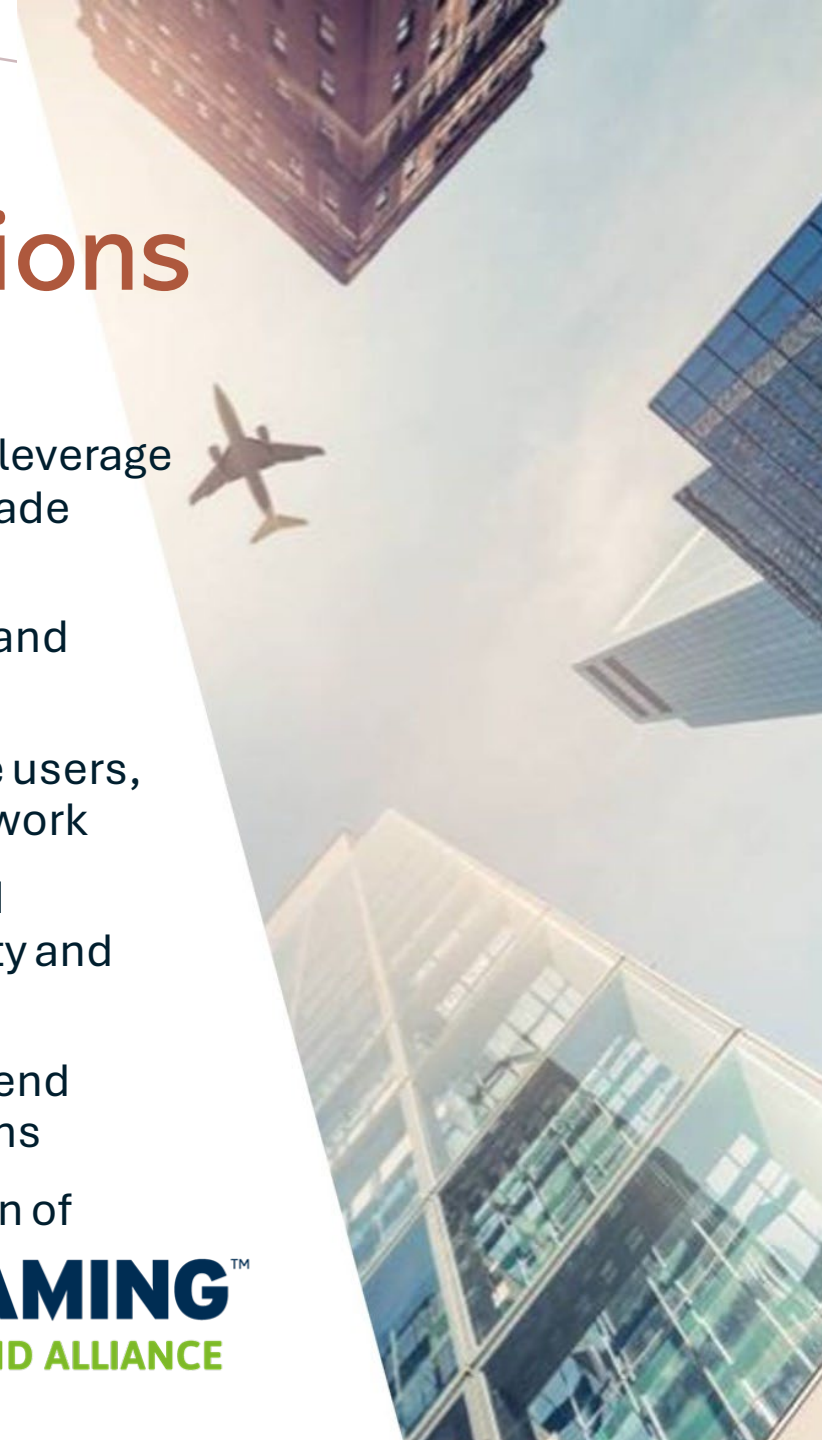
OPENROAMING™
WIRELESS BROADBAND ALLIANCE

Reduce the Digital Divide

- OpenRoaming can play a pivotal role in making cities more digitally inclusive, providing citizens with an important tool to thrive in a connected world:
  - Allows public networks to provide secure, simple and inclusive access for users
  - Digital connectivity, especially to previously underserved areas
- OpenRoaming delivers a reliable and high-quality Wi-Fi experience
  - Citizens sign up once for secure credentials and access to network
  - Citizens can use their home credentials when traveling to other areas where OpenRoaming is available
  - Visitors can sign up and obtain access to public areas

OPENROAMING™
WIRELESS BROADBAND ALLIANCE

OpenRoaming Provides Solutions



- **Wi-Fi Protected Access (WPA)2/3 Enterprise**: OpenRoaming networks leverage WPA2-Enterprise or WPA3 over-the-air encryption, offering enterprise-grade protection
- **Transport Layer Security:** OpenRoaming uses TLS to encrypt user data and protect it from unauthorized access
- **Secure Authentication**: OpenRoaming uses certificates to authenticate users, IDPs, and APs, ensuring that only authorized entities can access the network
- **End-To-End Encryption:** OpenRoaming ensures that there is end-to-end encryption between users and Wi-Fi networks, safeguarding data integrity and privacy
- **End to End Security:** The OpenRoaming PKI framework enables end-to-end security, helping to eliminate security threats like honeypots and evil twins
- **Secure RADIUS**: OpenRoaming uses RadSec for the secure transmission of authentication and accounting data

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OpenRoaming In Action:

- Loughborough University
- Cityroam Japan
- Delhaize Supermarkets
- Adventist Health US

Many case studies are available at
https://wballiance.com/openroaming/resources/

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Loughborough University

AdventistHealth

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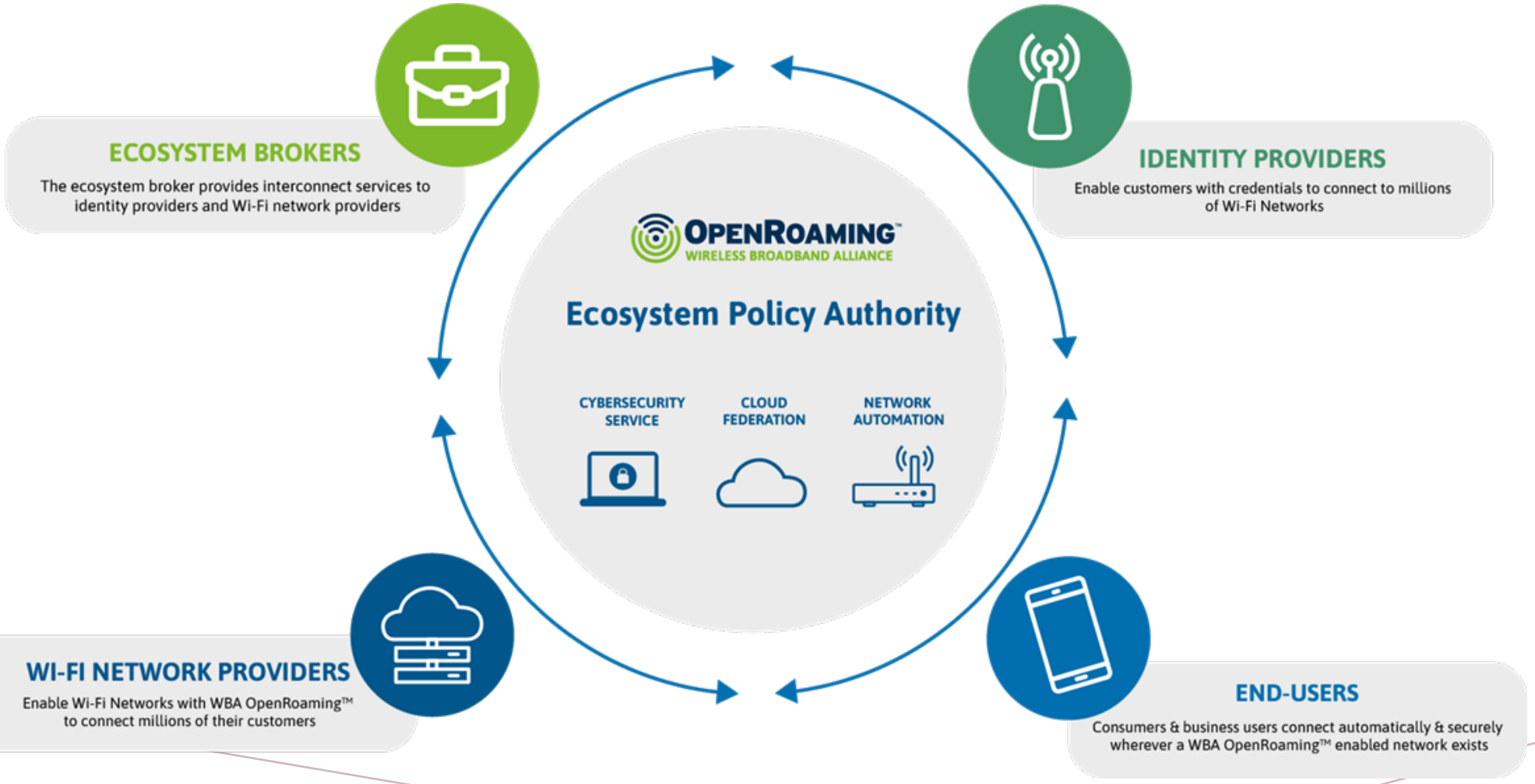
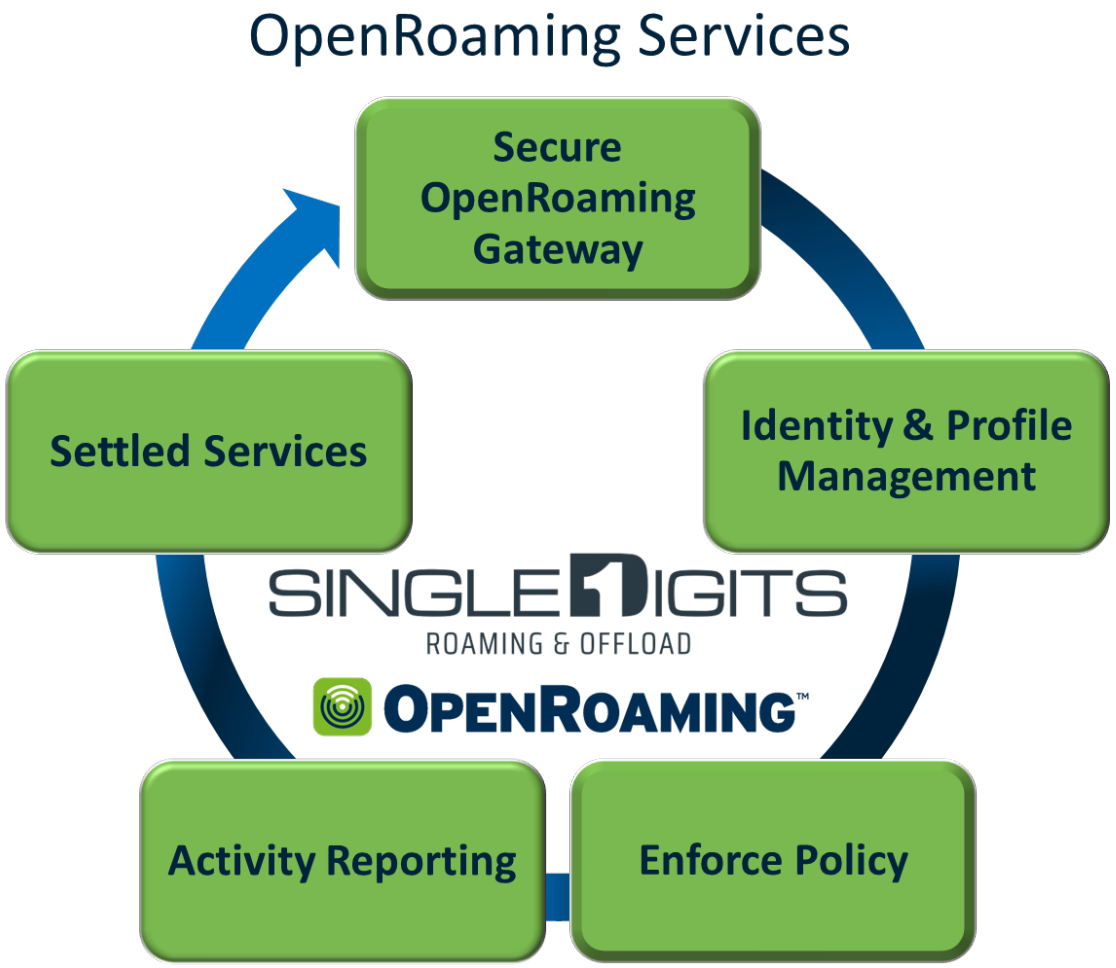
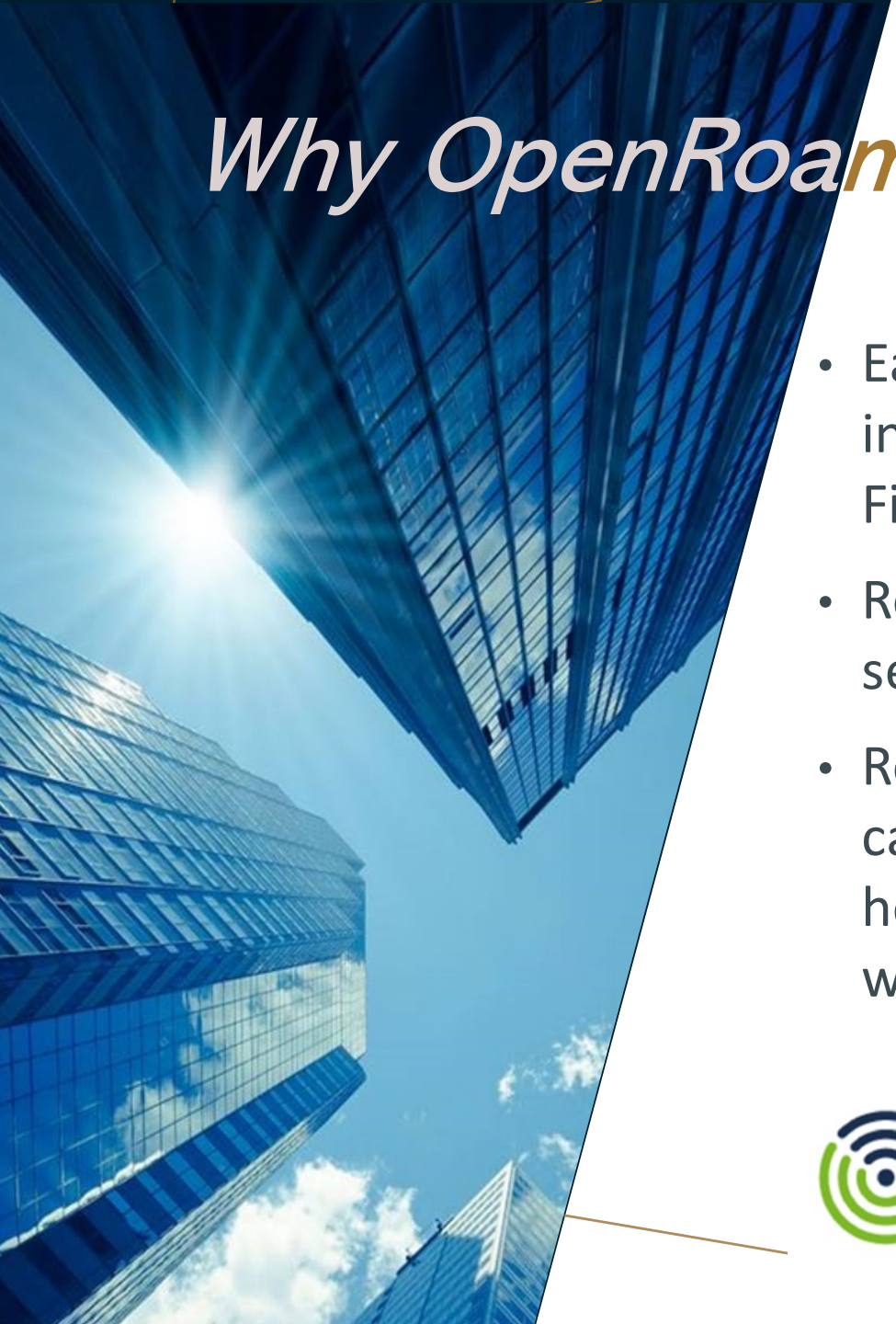
OpenRoaming Players



Single Digits – OpenRoaming Broker





Why OpenRoaming?

- Easy to deploy, secure standards-based infrastructure which can enable city Wi-Fi deployments
- Robust ecosystem of equipment and service providers available
- Robust library of documentation and case studies providing information on how to deploy OpenRoaming www.openroaming.org

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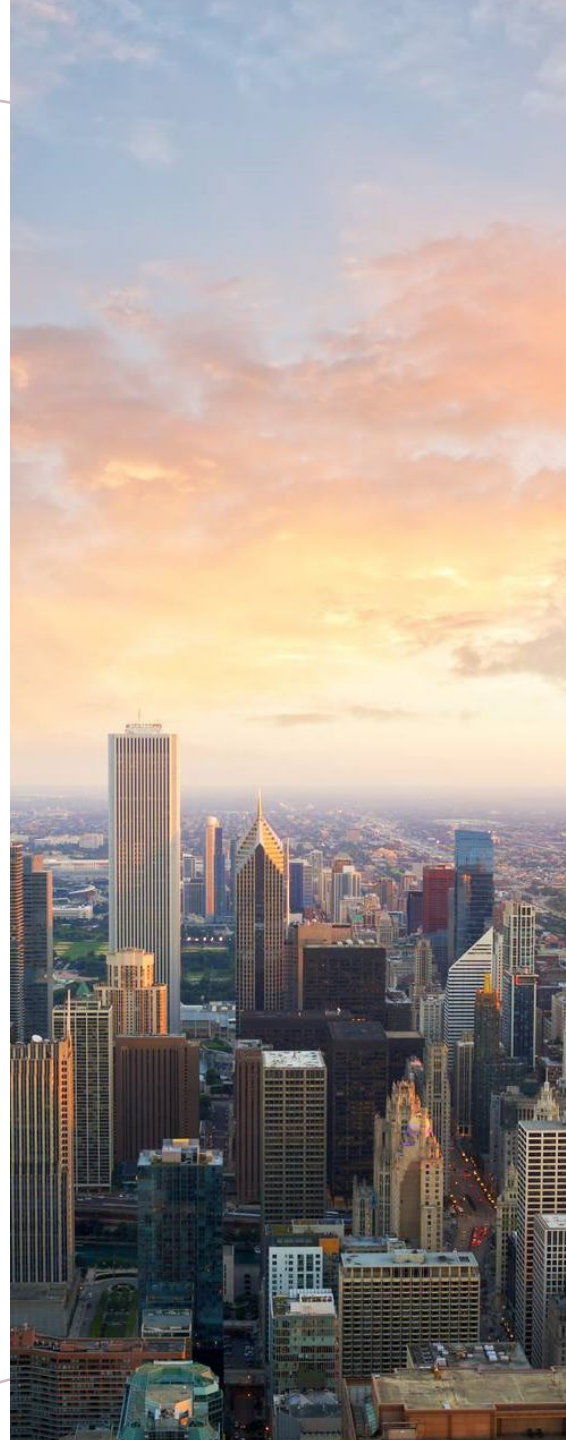

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Thank You!

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210-865-2953

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OpenRoaming: Simplifying Citizen Access In Wi-fi Connected Communities

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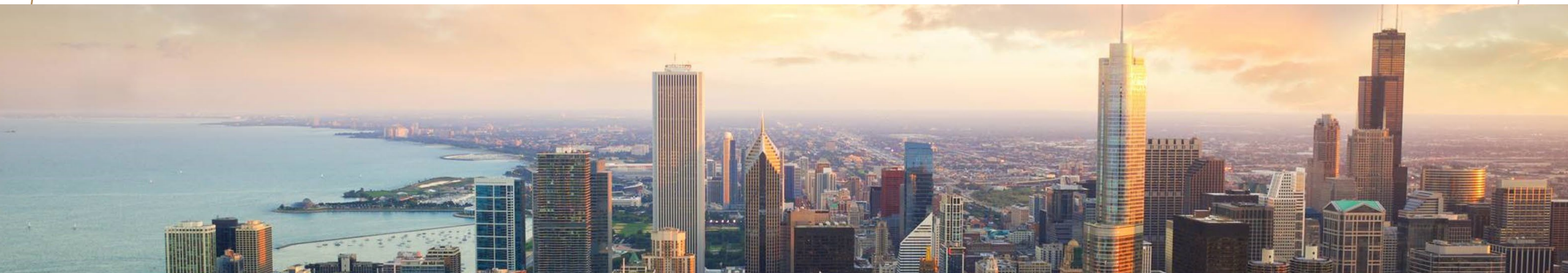

Wireless Global Congress Americas

Panel: Understanding the Challenges and Opportunities to Enable Smart and Connected Communities that Can Thrive

Alphonso Jenkins

Chair, Connected Communities Forum,
Wireless Broadband Alliance.

Mittal Parekh

Senior Director, Product Marketing, Technical Marketing and Influencer Marketing, RUCKUS Networks.

Greta Byrum

Principal, Broadband & Digital Equity, HR&A.

Mark Miller

Co-Founder & President, Cutting Edge Telecommunications.

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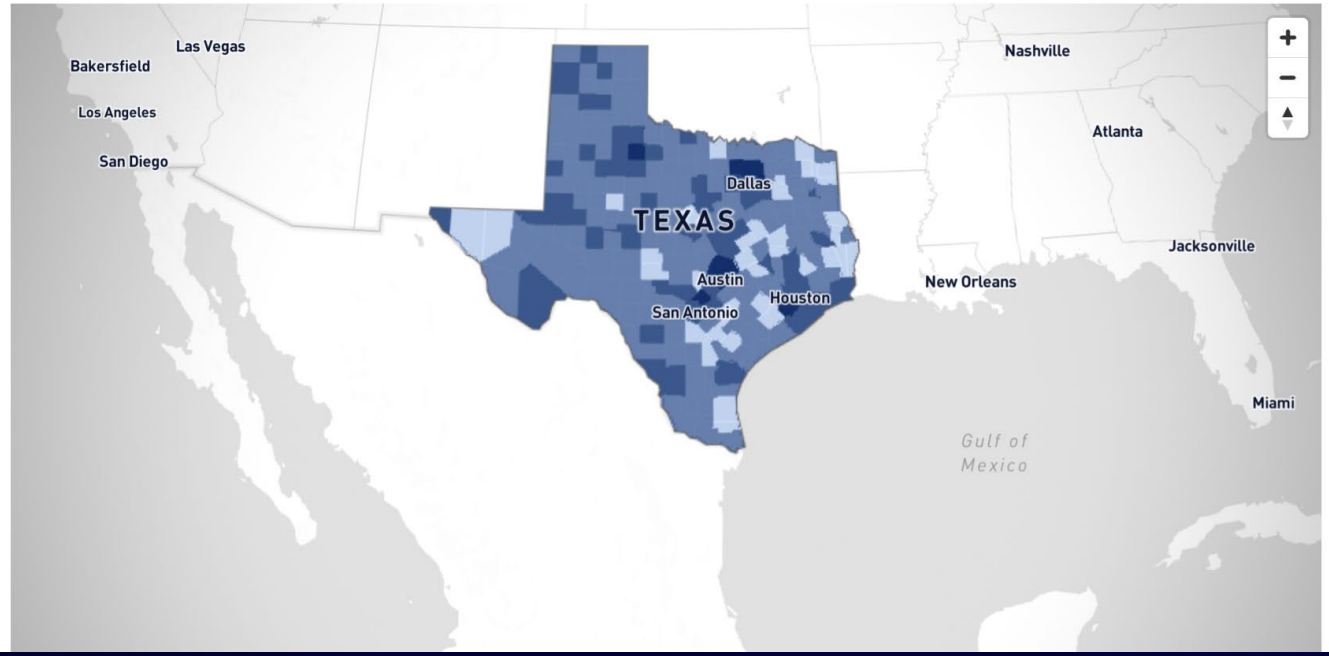
GEOGRAPHY*

Texas

- Understanding Digital Opportunity
- Demographics of Digital Opportunity
- **Internet Adoption**
  - Internet Adoption
    - High-Speed Internet Adoption
    - Internet Adoption by Population
    - Unconnected Communities
  - Barriers to Adoption
    - Most Common Barriers to Internet Adoption
    - Internet Availability Matters
    - Internet Reliability Matters
    - Cost Matters
- Digital Literacy and Technical Skills
- Devices Matter

"Internet adoption" refers to full access to and use of the internet for everyday life. These charts show adoption as a measure of households subscribing to high-speed home internet service. In Texas, 7,042,046 (68.8%) households are connected to high-speed internet at home. Some counties have lower rates of internet adoption than others.

Share of Household Internet Adoption by County



www.digitalopportunityfortexas.com/data-dashboards/home

Wireless Global Congress Americas

Tiago Rodrigues

President & CEO, Wireless Broadband Alliance.

Day 1 – Closing Remarks

Wireless Global Congress Americas

DRINKS AND NETWORKING RECEPTION

THE ATRIUM AT THE PLAZA OF THE AMERICAS

6.00 – 8.00 PM CT